GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES

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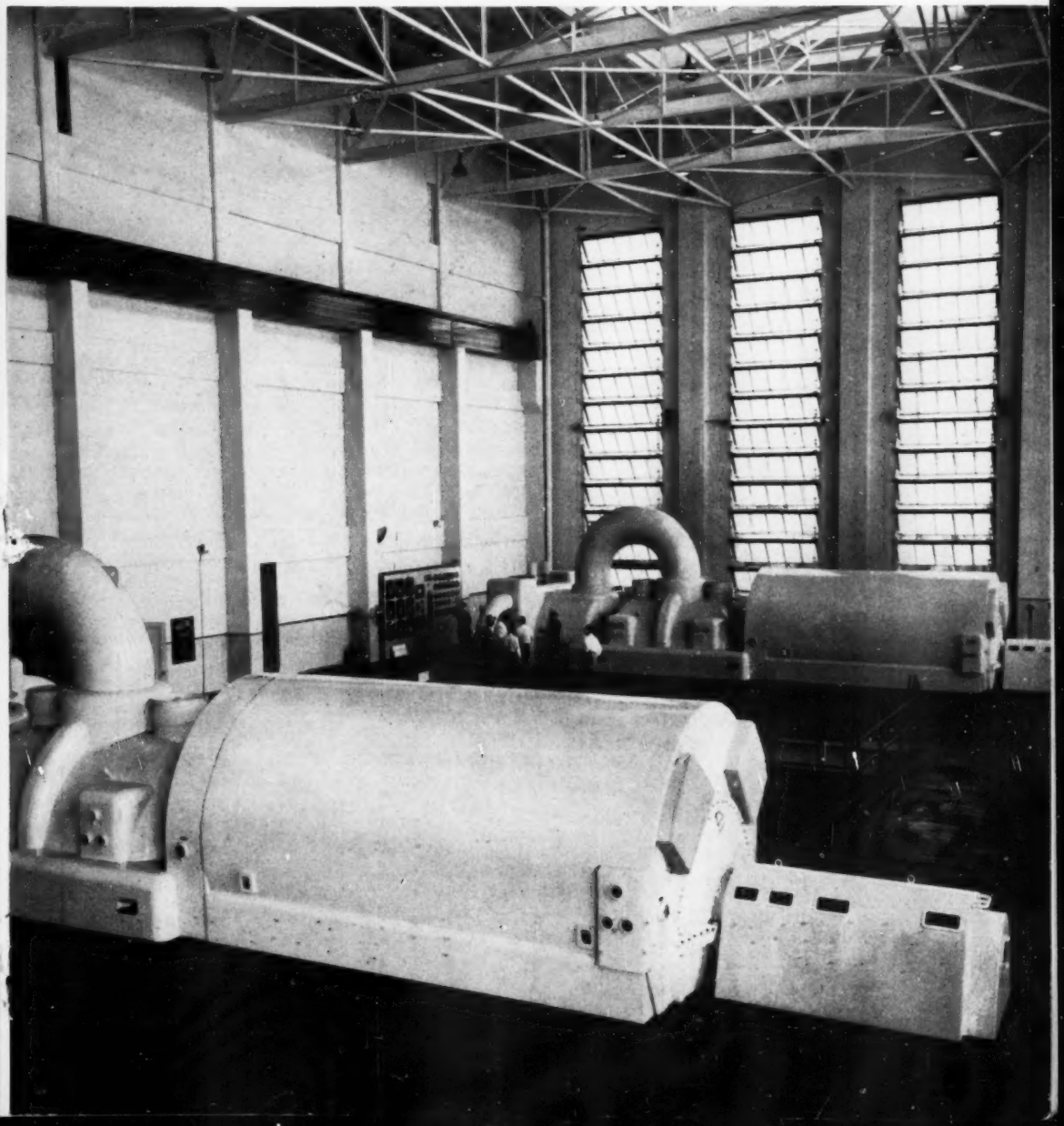
Power

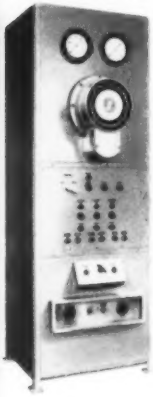
February
1951

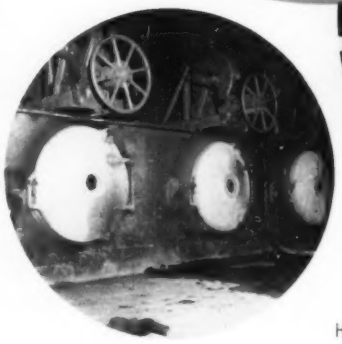
A McGRAW-HILL PUBLICATION

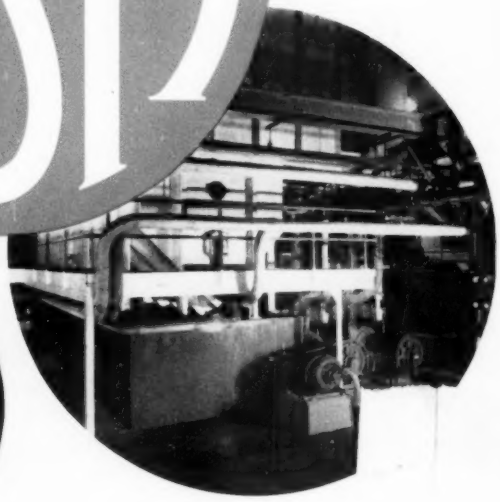


A mark of engineering excellence

Automatic Sequence Head—the "brain" of the HYDROVAC Dust handling systems







For more than twenty-five years, the letters A-S-H have appeared on most of the major pioneering advances in ash and dust handling equipment. Credit for these developments must be shared in a large degree with the engineers and operators, through whom and for whom the equipment was designed. Without their cooperation and creative imagination, these revolutionary improvements would not have been possible.

For example, in the early 1920's, it required one or two men to remove five tons of ash per hour. Now, with Hydrojet, many times that figure can be handled per hour, with no labor other than the turning on and off of valves. Dust handling has been made completely automatic with the Hydrovac System, and volumes up to 50 tons per hour are being handled in a number of plants.

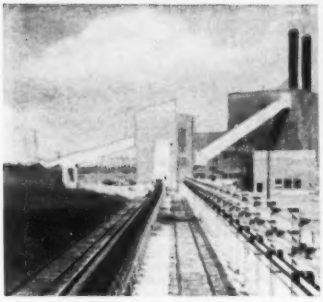
Today, the engineering skill and experience of our past quarter century are being devoted to the design of the equipment of tomorrow. "As always, A-S-H will pioneer in ash and dust handling."

THE ALLEN-SHERMAN-HOFF CO.
227 South 15th Street, Philadelphia 2, P
Offices and Representatives in Principal Cities

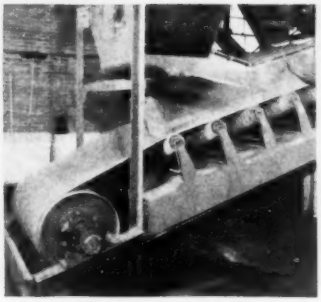
HYDROJET for ASH handling

HYDROVAC for DUST handling

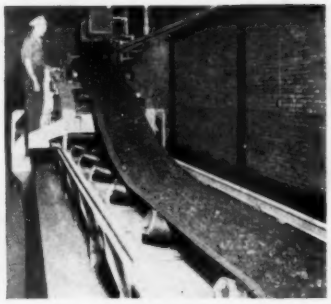
LINK-BELT engineering experience...



Belt conveyors deliver coal to storage yard and power plant.

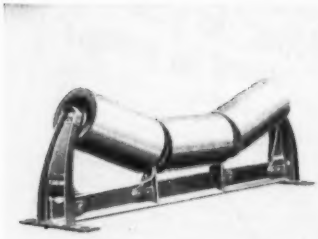


Chutes deliver graded coal to an ascending belt conveyor.

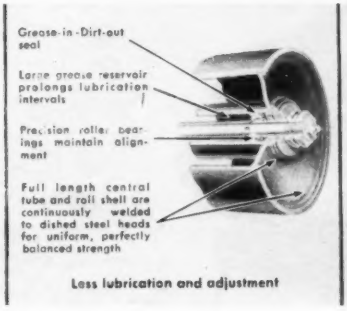


Distributing belt conveyor discharges coal to overhead bunker.

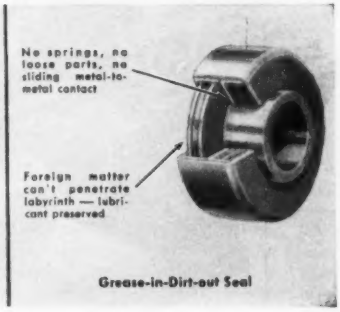
LINK-BELT quality components...



Standard for industry—L-B "100" Idler


Grease-in-Dirt-out seal
Large grease reservoir prolongs lubrication intervals
Precision roller bearings maintain alignment
Full length central tube and roll shell are continuously welded to dished steel heads for uniform, perfectly balanced strength

Less lubrication and adjustment


No springs, no loose parts, no sliding metal-to-metal contact
Foreign matter can't penetrate labyrinth — lubricant preserved

Grease-in-Dirt-out Seal

add up to your best bet in BELT CONVEYORS

In power plants all over the world, LINK-BELT Belt Conveyors provide reliable, efficient coal handling

Get the finest in modern coal handling in your power plant. It can be as simple as calling in a Link-Belt engineer while you're still in the planning stage.

Thousands agree Link-Belt builds the finest belt conveyors on the market today. More, it has the most complete line of components—all types and sizes—idlers, take-ups, pulleys, trippers, bearings and power transmission drives. Plus all related equipment—other types of conveyors, feeders, elevators, car dumpers and shakers, weigh larries.

Equally important, Link-Belt Belt Conveyor engineers can draw on the broadest coal handling experience in the industry. They'll work with you and your consultants—help you come up with the right system for your requirements.

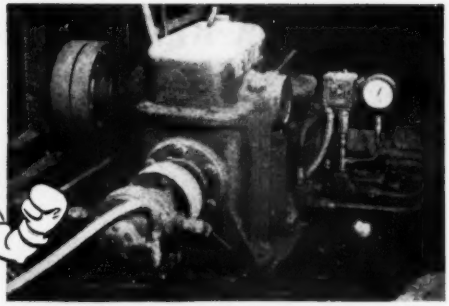
Call or write the Link-Belt branch office nearest you for the services of a belt conveyor expert.

LINK-BELT

BELT CONVEYOR EQUIPMENT

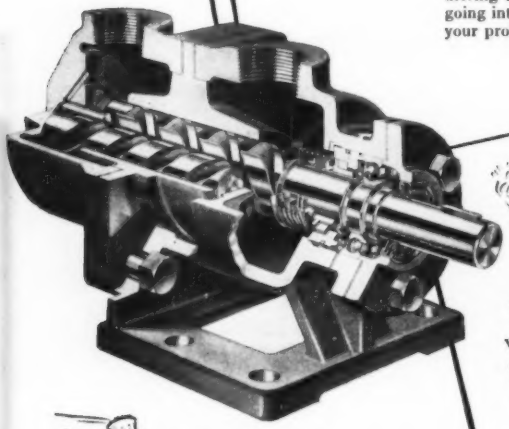
LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices in Principal Cities. 12,248

De Laval products at work!



Tough service?... You bet!

0 to 800 rpm in 8/10 Second . . . 26 Times per Minute. And this De Laval speed reducer takes it and likes it. This particular unit is driving a conveyor belt that automatically feeds and measures billets going into a shear. If you are rough on reducers in your plant, tell your problems to one of our power transmission engineers.



What do you want to pump?

Molasses, Glue, Lard, Soya Oil, Film Dope, Corn Syrup, Vegetable Oil, Paste, Fuel Oil, Shortening, Resin, Varnish, Linseed Oil, Viscose Rayon, Liquid Latex . . .

We frankly don't know all the other products that an IMO can pump, but if you want a better way to transfer fluids like these from one place to another, chances are an IMO can do the job for you. The IMO is a screw-type rotary pump. Its axial flow design permits liquids to be pumped close to the axis of the rotor. This means low liquid velocity through the pump and quiet pulsation-free flow. Capacities range to 1000 gpm at 500 psi and 150 gpm at 1500 psi.

There's a new idea here!

We've simplified the already simple centrifugal pump! Our new GS pump is designed so that every working part . . . every part subject to wear, is contained in one easily replaced unit rotor assembly. Through our Service and Exchange Plan new rotor assemblies are available for immediate shipment from conveniently located stocks throughout the country.

This means good service, and if maintenance ever does become necessary, all you have to do is remove the cover and end plate bolts, lift out the old rotor and drop a new one in place. *It's that easy!* Capacities to 400 gpm — heads to 230 feet.

DE LAVAL STEAM TURBINE CO., TRENTON 2, N. J.

TURBINES • HELICAL GEARS • CENTRIFUGAL BLOWERS AND COMPRESSORS
CENTRIFUGAL PUMPS • WORM GEAR SPEED REDUCERS • IMO OIL PUMPS

50th DE LAVAL Anniversary

Power

FEBRUARY 1951 · VOLUME 95 NUMBER 2

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February 1951 **POWER** Vol 95—No. 2

(Member ABC and ABP)

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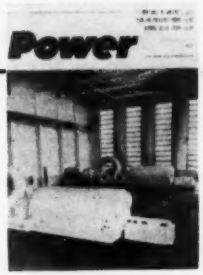

PEARL HARBOR will always be a meaningful name to Americans. Now, as we start along a path strangely like that of nine years ago, it is perhaps fitting that a new power plant at Pearl should stand as a symbol of a nation rearming in time of danger.

Like forward-looking utilities all over the U. S., Hawaiian Electric Co is expanding to meet mobilization demands. Waiau Station, pictured on our cover, now boasts two 40,000-kw 850-psi 950-F units. The second was dedicated in 1950.

Next month . . .

■ Big package for March is Part I of the new POWER HANDBOOK. First published in 1943, it turned out to be one of our most popular special sections. It ran through two reprintings, left us unable to meet a continuing demand. So we're bringing out a completely revised edition—bigger, better, easier to look at and use. Part I will cover: (1) weights and measures (2) practical math (3) math tables (4) mechanics and mechanisms (5) materials (6) fundamentals of heat (7) steam tables (8) practical electricity (9) hydraulics and pumping (10) piping, flow, tanks.

■ This month, pp 114-117, you get basic facts on using hot-lime-soda process in combination with zeolite. In March we follow through with a case history of a plant that's operated this combination, knows what it can do. Watch for their experience report.

■ Liquefied petroleum gas (LPG for short) has gone a long way from the days when it was only a way to run a gas range out beyond the mains. Now that it's finding wide industrial use, power engineers need to know how to handle, store and burn it. You'll find the answers in March.

. . . and future months

■ A topnotch series on maintaining centrifugal refrigeration compressors kicks off in March with a quick review of the way these machines operate. Then come down-to-earth articles on operation and maintenance procedures.

GIVE THESE BEARINGS *EXTRA PROTECTION*

Photo courtesy General Electric Company

Keep turbine systems free of rust, sludge and foam, by using TEXACO REGAL OILS (R&O)

You won't have to worry about "oil starved" bearings when your turbines are lubricated with *Texaco Regal Oils (R&O)*. These oils are famous for their ability to keep turbine systems free from rust, sludge and foam . . . assuring full circulation of lubricant to maintain normal bearing temperatures and to keep governor response instantaneous.

Only the finest base stocks are used in *Texaco Regal Oils (R&O)*. In fact, *Texaco Regal Oils* were world-famous turbine lubricants for many years before rust- and oxidation-inhibiting additives came into use. Now, with these additives—plus special processing to prevent foaming—*Texaco Regal Oils (R&O)* are truly outstanding. Count on them for extra-long service life . . . extra protection for your turbines.

Texaco Regal Oils (R&O) meet the stringent requirements of all leading turbine builders and are the choice of turbine operators everywhere. Let a Texaco Lubrication Engineer give you full details.

Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, New York.

TEXACO

TEXACO Regal Oils (R&O)

FOR ALL TURBINES

TUNE IN . . . TEXACO presents MILTON BERLE on television every Tuesday night. METROPOLITAN OPERA radio broadcasts every Saturday afternoon.

Power

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...with Power readers...

CAN YOU HELP US?

If you visited the Power Show back in December, you may have noticed a display of 50-year-old POWER "ads" in our booth. In making up this display we discovered some gaps in our collection of POWER issues. So now we're looking for complete bound volumes of POWER for the years 1884 through 1890, and of the predecessor publication *Steam* for the years 1882 and 1883. Perhaps you have these volumes or know someone who has and wouldn't mind making them available to us. If you can put us on the track, you'll be doing us a real favor.—*Ed.*

"PHASE-ROTATION TIP . . ."

After reading Roth's article, "Induction Generators for Small Loads," in your Dec issue, I recalled a phase-rotation tip that's worth passing on.

We had just overhauled a group of induction motor-generator sets. These sets are normally started from the dc end. Since the machines were in the 1000-kw 2200-v class, we were a little concerned about getting the phase sequence correct before throwing them across the line.

Our main precautionary step was to connect a pt in series with one phase leading to the motor. A voltmeter was hung on the pt's secondary. Then with the motor brought up to synchronous speed (from the dc end) the motor's ocb was closed. If the volt-

(*Continued on page 202*)

...lines and bylines

Arthur Pollitt

POWER FOR LONDON, with its more than 6 million people, comes from 30 plants having a total capacity of 2731 mw. New construction and extensions will soon add another 1307 mw. Directly responsible to BEA Divisional Controller for over-all efficiency of this supply is the new Deputy Divisional Controller. He's an old friend to many U. S. power engineers—Arthur Pollitt.

Born in Manchester and educated at Salford, Arthur Pollitt served an indentured apprenticeship and held a number of engineering posts before joining Brush Electrical and Engrg Co in 1913. There he took a leading part in installing power plants to meet World War I demands.

Interested as a youth in sailing, he later went to sea and took his degree in marine engineering. But the late Sir Leonard Pierce decided Arthur Pollitt was just the man he wanted to work on development of Barton Power Station. When Sir Leonard joined the London Power Co, Pollitt went with him. He was largely responsible for Deptford West, Battersea and other famous London power stations. And he played a vital part in the successful struggle to keep London's power services going during the days and nights of the great blitz.

Arthur Pollitt has traveled widely in the U. S. and his many friends here wish him well in his enlarged responsibilities.

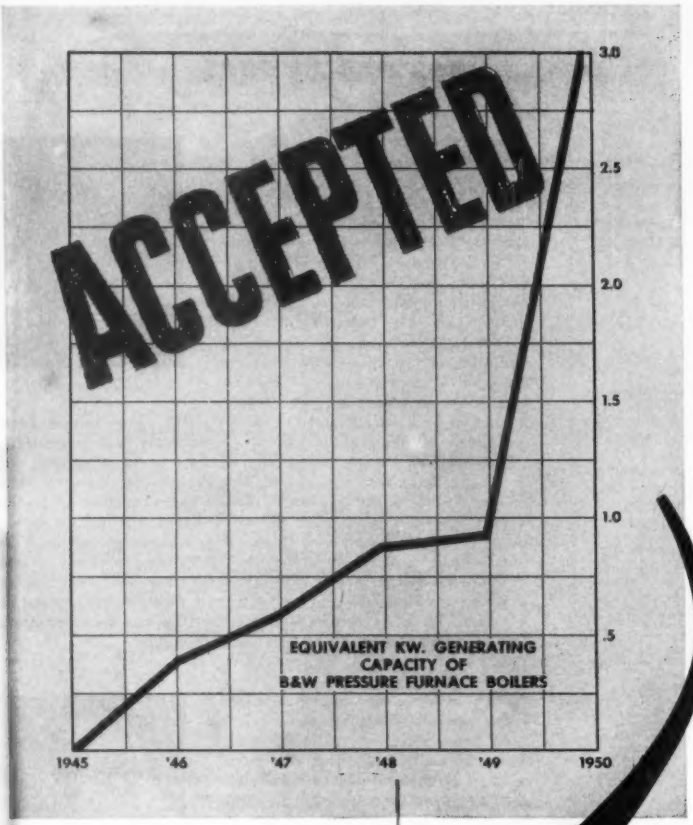
Arthur H Kuljian

INDIA'S TVA — the huge Damodar Valley project — is just one of the far-flung power developments with which Arthur H Kuljian has been associated as Chief Mechanical Engineer and Design Engineer of the Kuljian Corp. Besides the Bokaro Steam Station of the Damodar project, he has had major responsibilities in the planning for power plants in Chile, Venezuela and Sicily.

Since receiving degrees in both electrical and mechanical engineering at MIT, Arthur Kuljian has specialized in power-plant design. He draws on that experience in telling of the design features of Florida Power Corp's new Booth Point Plant (pp 92-95). His past association with that utility includes acting as project engineer on the Port Tampa Terminal expansion and the 1949-50 extension to Bayboro Station.

Jay Kapla

EX-SEAGOING ENGINEER Jay Kapla stepped from his last ship to what looked like a relatively quiet life ashore, generating power to compress gases. But he found he had to build the plant first. Some day we'll get Jay to tell the full story of the problems he met — and licked — in building his first diesel plant after a lifetime of operating plants designed by other engineers. Right now, however, Jay contents himself with passing along a few solid ideas on the purely practical side of diesel lubrication, covering changes he had to make in his plant to meet operating conditions. On pp 96-97, you'll find the story of how a simplified system of lube-oil purification can pay off in time and dollars for even a small diesel plant.



B & W puts the pre

NEW

...improved principle of boiler-furnace operation pioneered by B & W

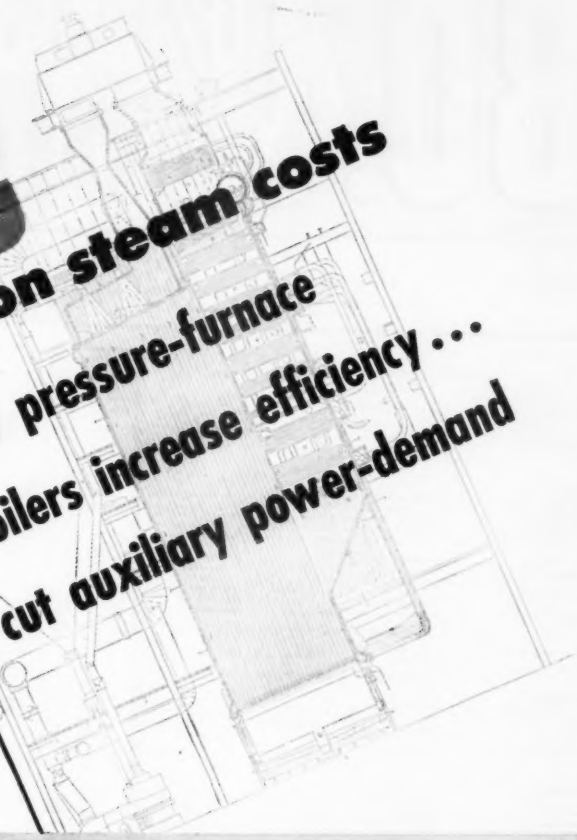
MAJOR COST SAVING ADVANTAGES

1. Eliminates ID fan—lowers demand charge.
2. Prevents air infiltration—provides higher boiler efficiency.
3. Simplifies draft control—permits quick, easy, effective adjustment to optimum combustion conditions at all loads.
4. Simplifies design—lowers initial cost of duct and stack arrangement.

ssure on steam costs

new pressure-furnace boilers increase efficiency . . . cut auxiliary power-demand

Another Example of B&W Engineering for Economy



Stacks will be shorter in 1951, as B&W Pressure-Furnace Boilers set the style in higher boiler efficiency and lower auxiliary power-demand.

Acceptance of this most recent type of furnace construction followed rapidly upon its first successful applications to Stirling, Integral-Furnace, Radiant, and Open-Pass units. Comparison of advantages in conventional vs. pressure-casing designs inevitably leads to a choice of the latter for *most* operating conditions.

As the chart shows, orders have been received for an equivalent generating capacity of about three million kw, comprising installations of Integral-Furnace and Radiant Boilers ranging from 250,000 to 1,357,000 lb. per hr. individual steam capacity. Fuels include gas, oil, and both pulverized and cyclone-fired coals.

Helping America's electric companies to keep power costs down is an 83-year tradition with B&W . . . currently evident in such pioneering developments as Cyclone-Firing, Gas-Recirculation, and Natural Circulation at pressures to 2500 psi. You'll want to learn the details of these significant features as they relate to your own company's future requirements. The Babcock & Wilcox Company, 85 Liberty Street, New York 6, N. Y.

BABCOCK & WILCOX

G-5327

80.4% OF THESE INSTALLATIONS DIAMOND

1950 Design Survey of Typical New

Compiled by B G A Skrotzki, Associate Editor

Company	Location	Plant Name	Consulting Engineers
600 TO 799 PSIG			
Iowa Public Service Co	Sioux City, Iowa	Kirk	
Southern Colorado Power Co	Pueblo, Colo Rocky Ford, Colo	Pueblo Rocky Ford	Pioneer Serv & Engrg Stearns-Roger Mfg Co
Maine Public Service Co	Caribou, Maine	Caribou	Stone & Webster
Western Colorado Power Co	Montrose, Colo	Montrose	
Mt Carmel Public Utility Co	Mt Carmel, Ill		A
UNDER 600 PSIG			
Southwestern Publ Service Co	Sunray, Texas	Moore County	Stearns-Roger Mfg Co
Saskatchewan Power Corp	Estevan, Sask	Estevan	R E Hanright
Otter Tail Power Co	Crookston, Minn	Crookston	J F Pritchard & Co
Montana-Dakota Utilities Co	Mobridge, S.D	Mobridge	Stearns-Roger Mfg Co
Iowa Public Service	Carroll, Iowa	Carroll	Black & Veatch
Central Kansas Power Co	Colby, Kansas	Colby	
Northern States Power Co	Fargo, N.D Centerville, Iowa Ottumwa, Iowa	Fargo Centerville Ottumwa	Pioneer Serv & Engrg Federal Engrg Co Federal Engrg Co
Iowa Southern Utilities Co			
Pacific Power & Light Co	Yakima, Wash	Sta Htg Plant	J Donald Kroecker
MUNICIPAL AND COOPERATIVE PLANTS			
Board of Public Utilities	Kansas City, Kansas	Quindaro No. 2	Burns & McDonnell
Central Power Electric Coop Inc	Voltaire, N.D	Wm J Neal	Vern E Alden Co
Dairyland Power Cooperative	Alma, Wis Cassville, Wis	Alma E J Stoneman	Vern E Alden Co Vern E Alden Co
City of Muscatine	Muscatine, Iowa		Stanley Engrg Co
Corn Belt Power Cooperative	Humboldt, Iowa	Humboldt	Stanley Engrg Co
Southwestern Federated Pwr Coop	Creston, Iowa	Creston	Stanley Engrg Co
Brazos Riv Transmission Elec Coop	Belton, Texas	Bob Poage	Lasmore & Douglass
City of Tallahassee	St Marks, Fla	St Marks	Reynolds, Smith & Hill
City of Lafayette	Lafayette, La		Barnard & Burk
Minnkota Power Cooperative	Grand Forks, N.D	Franklin P Wood	Ellerbe & Co
Dept of Municipal Service	Wyandotte, Mich		Emery, Markest, Emery
Water, Gas & Electric Dept	Danville, Va	Brantly	Chas T Main, Inc
Manitowoc Public Utilities	Manitowoc, Wis		
Greenville Utilities Commission	Greenville, N.C	Greenville	W C Olsen
Borough of Chambersburg	Chambersburg, Pa		A C Wood Assoc
City Water & Light Dept	Ottawa, Kansas		Black & Veatch
City of Jackson	Jackson, Minn		Pfeifer & Shultz
Borough of Etna	Etna, Pa		Lutz & May
Department of Utilities	Fremont, Nebr		Lutz & May
Orrville Municipal Utilities	Orrville, Ohio	N Vine St	H R Hadlow
City of Colorado Springs	Colorado Springs, Colo		Lutz & May
Water & Light Department	Thomasville, Ga		
City of Cedar Falls	Cedar Falls, Iowa		Stanley Engrg Co
Frankfort Light & Power Plant	Frankfort, Ind		Emery, Markest, Emery
City of Weyburn	Weyburn, Sask		
City of Medicine Hat	Medicine Hat, Alberta		

A – Air cooled
AAd – Arsenical Admiralty
AC – Allis-Chalmers Mfg Co
Ad – Admiralty
Adi – Admiralty, inhibited
AlB – Aluminum-bronze
AlBr – Aluminum-brass
AnAd – Antimony-Admiralty
An – Anthracite
AsAd – Arsenical Admiralty

[illegible]ical copper
[illegible] Wilcox Co
[illegible]ineering-Super-

DL – De
EC – Er
EE – En
EI – E
EW – E
FE – F
G – N
GE – G
H – H
Hy – H

List Published in POWER, December, 1950

1950 Design Survey of

Compiled by B G A Skrotzki, Associate Editor

Company	Location	Plant Name	Consulting Engineers	First operation, new units	Nominal pressure, psig	Nominal temperature, F
1500 PSIG AND ABOVE						
Indiana & Michigan Electric Co	Lawrenceburg, Ind	Tanners Creek	Amer. Gas & Elec Co	1-51[1]	2000	1050[1]
Consolidated Edison Co of N. Y	Astoria, Queens, N.Y.	Astoria		12-52 4-53	1800	1000[1]
Central Hudson Gas & Elec Corp	Danskammer Pt, N.Y.	Danskammer	Burns & Roe, Inc	1-52[1]	1630	1000[1]
Jersey Central Power & Light Co	South Amboy, N.J	South Amboy	Burns & Roe, Inc	12-52	1650	1000[1]
Wisconsin Electric Power Co				12-52	1575	1000[1]
Long Island Lighting Co	Glenwood Land'g, NY	Glenwood No. 3	Ebasco Services, Inc	1952	1525	1000[1]
Public Service Elec & Gas Co	Sewaren, N.J	Sewaren		1951	1500	1050[1]
1000 TO 1499 PSIG						
Toledo Edison Co	Toledo, Ohio	Acme	G W Southoff	1951 2-49	1450 820	1000 950
Cincinnati Gas & Elec Co	New Richmond, Ohio	Clermont	Electric Advisors, Inc	3-52	1450	1000[1]
Central Illinois Publ Service Co	Hutsonville, Ill	Hutsonville	Sargent & Lundy	1952	1450	1000[1]
Virginia Electric & Power Co	Wheelwright, Va	Chesterfield	Stone & Webster	5-52	1450	1000[1]
Carolina Pwr & Light Co	Lumberton, N. C	Lumberton	Ebasco Services Inc	6-52	1450	[illegible]
Carolina Pwr & Light Co	Goldsboro, N. C	Goldsboro	Ebasco Services Inc	6-52	1450	1000[1]
Niagara-Mohawk Pwr Corp	Nr Albany, N. Y	Albany		1952	1450	1000
New York State Elec & Gas Corp	Johnson City, N. Y	Goudey	Gilbert Associates Inc	1951	1450	1000
Illinois Power Co	W. of LaSalle, Ill	Hennepin	Sargent & Lundy	10-53	1450	1000
Florida Power & Light Co	Nr Miami, Fla	South Florida	Ebasco Services Inc	8-52	1450	1000
Potomac Electric Power Co	Washington, D. C	Benning	Stone & Webster	1952	1450	1000
Duke Power Co	Mt. Holly, N. C	Riverbend		5-52 7-52	1300 1300	950 950
Duquesne Light Co	Elrama, Pa	Elrama		12-51	1300	950
Iowa Power & Light Co	Des Moines, Iowa	Des Moines, No. 2	United Lt & Rwy Serv United Lt & Rwy Serv Black & Veatch	8-48 5-49 12-50	1290 400 1290	925 750 925
Texas Electric Service Co	Fort Worth, Texas	North Main	Ebasco Services, Inc	3-52	1250	955
Wisconsin Power & Light Co	Sheboygan, Wis	Edgewater	Sargent & Lundy	6-51	1250	950
Georgia Power Co	Yates, Ga	Yates	Southern Services, Inc		1250	950
Columbus & S. Ohio Elec Co			Ebasco Services Inc	1953	1250	950
Minnesota Power & Light Co	Aurora, Minn	Aurora	Ebasco Services Inc	3-53	1250	950
San Diego Gas & Electric Co	San Diego, Calif	Silver Gate	Pioneer Serv & Engrg	8-50	1250	950
Pennsylvania Electric Co	Erie, Pa	Front St	Gilbert Associates, Inc	7-52	1250	950
Florida Power Corp	Oldsmar, Fla Avon Park, Fla St. Petersburg, Fla	Booth Point Avon Park Bayboro	Kuljian Corp Kuljian Corp Kuljian Corp	5-51 1953 7-52 12-49	1250 1250 1250 850	950 950 950 900
800 TO 999 PSIG						
Northern States Power Co	Minneapolis, Minn	Riverside Black Dog	Pioneer Serv & Engrg Pioneer Serv & Engrg	7-50 6-52	900 850	900 950
New York State Elec & Gas Corp	East Corning, N. Y	Hickling	Gilbert Associates, Inc	1952	850	950
Eastern Share Publ Service Co	Vienna, Md	Vienna	United Engrs & Constr	4-51	850	900
Hydro-Elec Pwr Comm of Ontario	Toronto, Ont	Richard L Hearn	Stone & Webster	11-51	850	900
	Windsor, Ont	Windsor	H G Acres & Co	9-51	850	900
Union Electric Power Co	Venice, Ill	Venice No. 2	Stone & Webster	10-50 12-50	850	900
Southern California Edison Co	Redondo Beach, Calif	Redondo	Stone & Webster	1949	850	900
Hartford Electric Light Co	Hartford, Conn	South Meadow	Stone & Webster	4-50	850	900
Public Service Co of Colorado	Denver, Colo	Arapahoe	Ebasco Services, Inc	10-50 4-51 1952	850 850 850	900 900 900
Alabama Power Co	Chickasaw, Ala	Chickasaw	Southern Services, Inc	1951	850	900
Mississippi Power Co	Harrisburg, Miss Meridian, Miss	Eaton Sweatt	Southern Services, Inc Southern Services, Inc	8-49 3-51	850 850	900 900

A – Air cooled
AAd – Arsenical Admiralty
AC – Allis-Chalmers Mfg Co
Ad – Admiralty
Adi – Admiralty, inhibited
AlB – Aluminum-bronze
AlBr – Aluminum-brass

AsCu – Arsenical copper
BW – Babcock & Wilcox Co
C – Coal, bituminous
CE – Combustion Engineering-Superheater, Inc.
CP – C A Parsons
CuNi – Copper-nickel
Cy – Cy[illegible]

DL – DeLaval Steam Turbine
EC – Erie City Iron Works
EE – English Electric
EI – Elliott Co
EW – Edge Moor Iron Works, I
FW – Foster Wheeler Corp

HAVING SOOT BLOWERS HAVE

SOOT BLOWERS

Steam Central-Station Installations

ypical New Steam Central-Station Installations

BOILERS							F-D FANS		I-D FANS		FUEL		FEED PUMPS		TURBINES								CONDENSERS							
	Capacity, each, 1000 lb per hr	Manufacturer	Boiler, waterwall surface, 1000 sq ft	Superheater surface, 1000 sq ft	Furnace volume, 1000 cu ft	Heat release, 1000 Btu per cu ft per hr	Furnace bottom	Economizer surface per boiler, 1000 sq ft	Air-heater surface per boiler, 1000 sq ft	Air-heater type	No.	Drive	Fuel	Preparation	No.	Drive	No.	Make	Rating, kw	Rpm	Exhaust	Stages	No.	Make	Rating, kw	Rpm	Exhaust	Stages	Circulating water	Surface, sq ft	Pressure, in. Hg abs
							DB	.....	51.8	.....	M																			
							.....	.....	.....	.....	.....																			
							DB	0	72.5	Tu	M																			
							DB	0	61.2	Ro	M																			
1	930	BW	31.0	95.9[3]	79.8	16.4	DB	.....	34.1	Tu	M[4]																			
2	1200	BW	22.7	35.0	90.0	17.0																								
							....	6.1	17.2	.....	.....																			
1	500	CE	20.5	32.4[3]	27.2	22.5	....	10.5	127.5	Tu	M																			
1	475	BW	15.0	37.6[3]	12.7	45.2	DB	34.6	60.1	Tu	M																			
1	795	CE	37.3	18.3[3]	102.0	10.4	DB	34.6	60.1	Tu	M																			
1	750	CE	33.1	.....	62.0	16.1	DB	20.4	111.0	Pl	M																			
1	822	CE	18.2	69.1[3]	67.8	16.5	DB	.....	66.6	Tu	M																			
							DB	.....	.....	Re	M																			
							DB	.....	.....	Re	M																			
							DB	.....	.....	Re	M																			
1	650	BW	21.7	32.6	47.4	16.9																								
2	500	BW	39.5	.....	49.5	16.3	....	.....	.....	.....	.....																			
1	706	CE	36.0	70.3[3]	64.2	14.7	....	.....	55.8	Re	M																			
1	525	CE	.....	.....	.....	.....																								
1[5]	750	CE	34.8	46.0	39.0	26.0	....	3.8	6.9	Tu	M																			
1[5]	550	CE	26.1	35.0	39.0	18.6	DB	0	31.8	Re,P	M																			
1	550	CE	26.1	35.0	39.0	18.6	DB	0	16.0	Tu	Mp																			
1	675	CE	32.8	42.3	58.0	15.8	DB	2.1	6.6	Tu	M																			
1	540	CE	29.3	43.7[3]	44.6	17.0	DB	0	14.0	Tu	M																			
1	525	CE	.....	.....	.....	.....	....	2.0	4.8	Tu	M																			
1	550	CE	26.1	35.0	39.0	18.6																								
1	675	CE	30.7	.....	55.4	14.4																								
1	810	CE	40.5	44.3[3]	68.0	15.6	DB	0	27.8	Re	M																			
1	810	CE	40.5	44.3[3]	68.0	15.6	....	0	4.8	.....	M																			
1	860	BW	28.9	35.1	69.8	.....	....	0	6.3	.....	.....																			
1	375	CE	18.0	13.5	24.5	19.0	....	0	4.9	Tu	M																			
	.....	.....	.....	.....	.....	.....	....	1.5	3.7	Tu	M																			
1	375	CE	27.1	14.5	25.2	18.4	DB	0	9.8	Tu	M																			
							....	0	5.0	Tu	M																			
1	775	CE	.....	.....	.....	.....	....	.....	.....	.....	T																			
1	660	BW	13.2	31.1	24.1	30.0	....	.....	.....	.....	T																			
1	975	CE	40.9	36.2	74.0	15.4	....	.....	.....	.....	M																			
1	650	CE	27.0	.....	44.0	18.0																								
2	425	CE	15.7	16.2	31.0	17.9																								
1	575	BW	9.7	21.0	25.0	28.7																								
							ST	0	65.3	Re	M																			
2	400	CE	19.2	25.7	25.5	19.6	DB	0	58.4	Tu	M																			
							DB	0	54.0	Tu	M																			
1	450	BW	.....	.....	26.0	.....	DB	0	54.0	Tu	M																			
1	450	BW	.....	.....	26.0	.....	....	11.5	0	.....	Mp																			
1	450	BW	.....	.....	26.0	.....																								
1	330	BW	21.9	.....	.....	24.3	....	2.9	6.6	Tu	Mp																			
							....	2.5	6.3	Tu	Mp																			
							DB	0	14.6	Tu	M																			
							....	.....	† 4.8	Tu	M																			
1	570	BW	13.5	22.9	37.5	20.0	DB	0	5.9	Tu	M																			
1	600	CE	17.4	21.0	43.3	17.6	....	4.4	16.8	Tu	M																			
2	220	BW	24.4	8.7	12.5	22.4	....	.....	8.6	Tu	M																			
1	500	BW	23.3	10.6	21.0	17.6	....	.....	.....	.....	M,T																			
2	850	BW	49.1	18.8	69.6	15.5	DB	0	7.6	Tu	M																			
2	650	BW	44.4	17.6	52.5	15.0																								
							DB	11.6	0	.....	M,T																			
1	900	BW	29.0	29.2	83.8	13.7	DB	0	.....	Re	M																			
1	900	BW	29.0	29.2	83.8	13.7	DB	.....	.....	Tu	M																			
							DB	.....	0	.....	.....																			
3	400	BW	7.3	14.8	13.9	39.0	DB	0	4.3	Tu	T																			
							....	0	0	.....	MT																			
1	450	BW	25.7	14.4	38.4	14.7	....	.....	0	.....	Mp																			
							....	.....	.....	.....	MT																			
1	450	BW	33.1	19.8	41.9	14.3	DB	0	1.9	Tu	M																			
1	450	BW	33.1	19.8	41.9	14.3	DB	.....	7.3	Tu	M	D	M	Hy	P	C	13.9	2650	1M,1T	R	5	3600	WE	1.25	3	A	6.0	2	Ad
1	450	BW	33.1	19.8	41.9	14.3																								
1	425	CE	27.2	10.5	21.2	24.0	....	5.5	0	.....	M	V	M	V	SS	C	11.0	2100	1M,1T	R	5	3600	GE	1.0	3	A	6.0	1	Ad
1	230	RS	20.2	7.8	14.8	20.2	....	2.9	0	.....	MT	Mo,V	MT	Mo,V	SS(252)	C	11.2	2000	2M,1T	R	10	3600	EI	.....	.....	.....	.....	.....	.....
1	425	BW	9.9	10.4	22.3	24.3	....	.....	0	.....	M	.....	M	Mo	SS(84)	L	.....[11]	.....	2M	.....	1.5	3600	CP	0.75	2	A	2.1	2	.....
							DB	0	0	.....	M	D,V	M	.....	G	G	980[11]	.....	2T	R	5	3600	CP	0.75	3	A	4.8	2	.....

L – Lignite
M – Motor drive
Mo – Magnetic coupling
MI – Murray Iron Works Co
My – Two motors per fan
MT – One motor, one turbine per fan
N – Non-metal
Pl – Plate
R – Regulator
Re – Regenerative
RS – Riley Stoker Corp
S – S... Co
TC – Traveling-grate stoker
Tu – Tubular
UF – Underfeed stoker
UI – Union Iron Works
V – Vane control
WB – Wm Bros Boiler & Mfg Co
WE – Westinghouse Electric Corp
WI – Wickes Boiler Co
† – Revised, first listed 1949 survey
‡ – Reheat to 1000F
§ – Includes reheater
* – AIEE-ASME preferred standard
1 – 7,500 kw house generator
2 – AIB in air-cooler section
3 – Forced circ...
4 – 2 units in ...
10 – Two-section ...
11 – Btu per ...
12 – 2 fans
13 – Extract...
14 – Also ...

"Cleaner boilers at lower cost" . . . that is the reason why the central stations (the most critical buyers) express such overwhelming preference for Diamond Soot Blowers year-after-year-after-year. Diamond performance superiority is based upon better design, correct application engineering and the unique Diamond Service Policy.

At the time this advertisement was prepared, soot blower requirements had been purchased by all but three plants on the list. This will not significantly affect the result.

Diamond Dominates in Soot Blowers . . . now as in previous years . . . because Diamond Soot Blowers mean better boiler cleaning at lower cost.

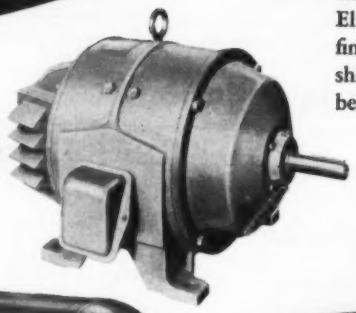
DIAMOND POWER SPECIALTY CORP.

LANCASTER, OHIO

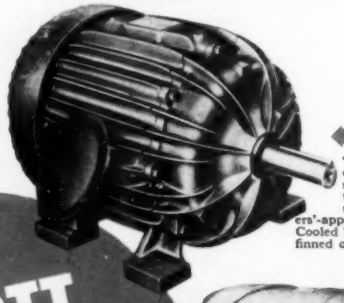
Diamond Specialty Limited, Windsor, Ontario

In motors from 1 hp up you're a step

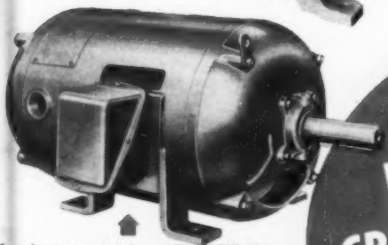
Looking for a dependable motor in any standard type, 1 hp or larger? You'll find it in this complete line, with the backing of the Crocker-Wheeler name plus the Elliott name—double assurance that you're getting as fine a motor as skilled engineering and veteran workmanship can turn out... Some representative types shown below. Write for bulletins.



DC dripproof and dripproof-protected types Form F, in ratings to 7½ hp. Form H, 10 to 200 hp.

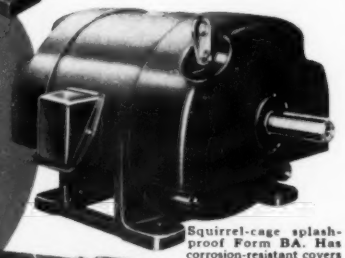


"Sealedpower" totally-enclosed fan-cooled squirrel-cage motors, 3 to 125 hp. Also explosion-proof underwriters'-approved, 20 to 125 hp. Cooled by air blown along the finned outer case.

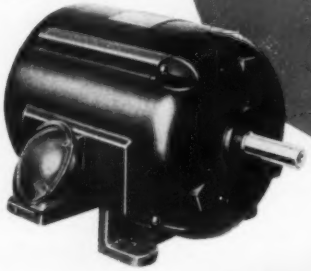


Wound-rotor protected type Form BW. For slow, smooth acceleration, high starting torque with low starting current, or variable speed. Drip-proof, splash-proof, 1 to 200 hp.

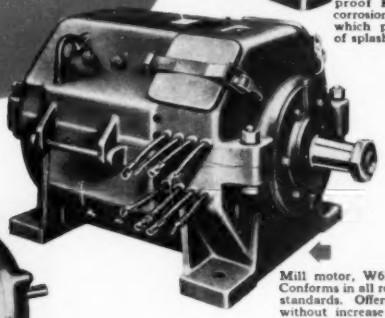
ELLIOTT
CROCKER-WHEELER
Integral
motors



Squirrel-cage splashproof Form BA. Has corrosion-resistant covers which prevent entrance of splashing liquids.

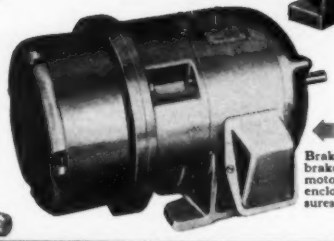


Squirrel-cage, totally-enclosed, non-ventilated Form BE. Available up to and including 3 hp at 1800 rpm, for applications requiring protection against dust, fumes, moisture.

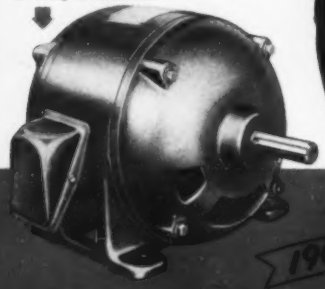


Mill motor, W600 Series, DC. Conforms in all respects to AISE standards. Offers more power without increase in frame size.

Squirrel-cage protected type Form BA. An open dripproof motor for general purpose use. Available in wide modifications to meet a variety of conditions.



Brake motor using latest disk type brake mounted on BA dripproof motor. Also available with totally enclosed and splashproof enclosures for AC or DC applications.



1901 HALF CENTURY OF POWER PROGRESS 1951

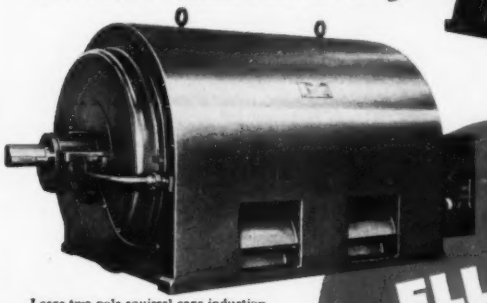
ELLIOTT

Crocker-Wheeler Division—Ampere, N. J.

DISTRICT OFFICES IN PRINCIPAL CITIES

ahead with ELLIOTT

Looking for a really big motor—big in quality as well as capacity? These fine Elliott motors have the exceptional strength and rigidity of welded steel construction in frame and spider with a number of other notable advantages. Fabri-steel construction marks the greatest advance in large motor design and construction since the turn of the century. Some of these outstanding motors are illustrated below. Bulletins for the asking.

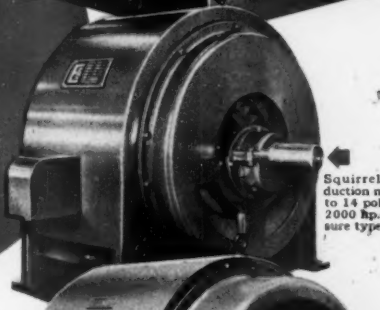


Large two-pole squirrel cage induction motor (350 hp up). A long forward step in two-pole design. Typical Elliott welded steel construction enables widest variation in type of enclosure.

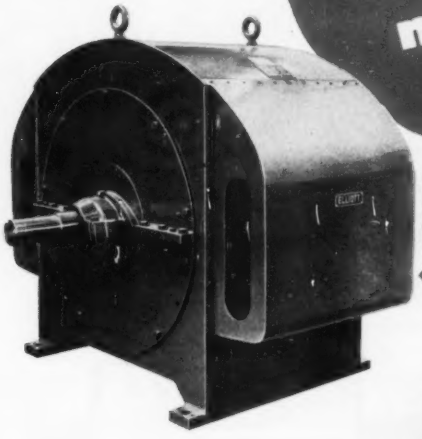
ELLIOTT large motors

Synchronous motor for gas compressor drive. Available with solid or split rotors, open or enclosed, engine type or coupled type, rigid construction.

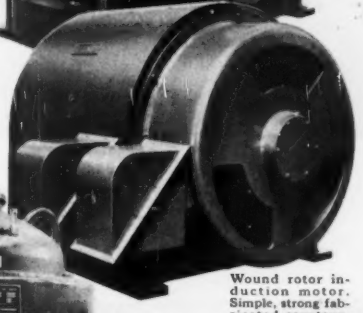
Totally-enclosed fan-cooled motor, cooled by heat exchanger located at top of unit. Two-pole ratings 300 to 4000 hp. For lower speeds, sizes equivalent to 50-hp, 14-pole, to 3000-hp, four-pole.



Squirrel-cage induction motor, four to 14 poles, 150 to 2000 hp. All enclosure types.



Outdoor splashproof squirrel-cage induction motor especially designed for outdoor installation without protective covering. 150 hp, 14 pole to 2000 hp, four-pole. 300 hp to 1000 hp two-pole.



Wound rotor induction motor. Simple, strong fabricated construction, sleeve or anti-friction bearings. Available in all types of enclosure.

Vertical outdoor splashproof squirrel-cage induction motor. Can also be made in open dripproof or indoor splashproof with minor changes in ventilating baffles.

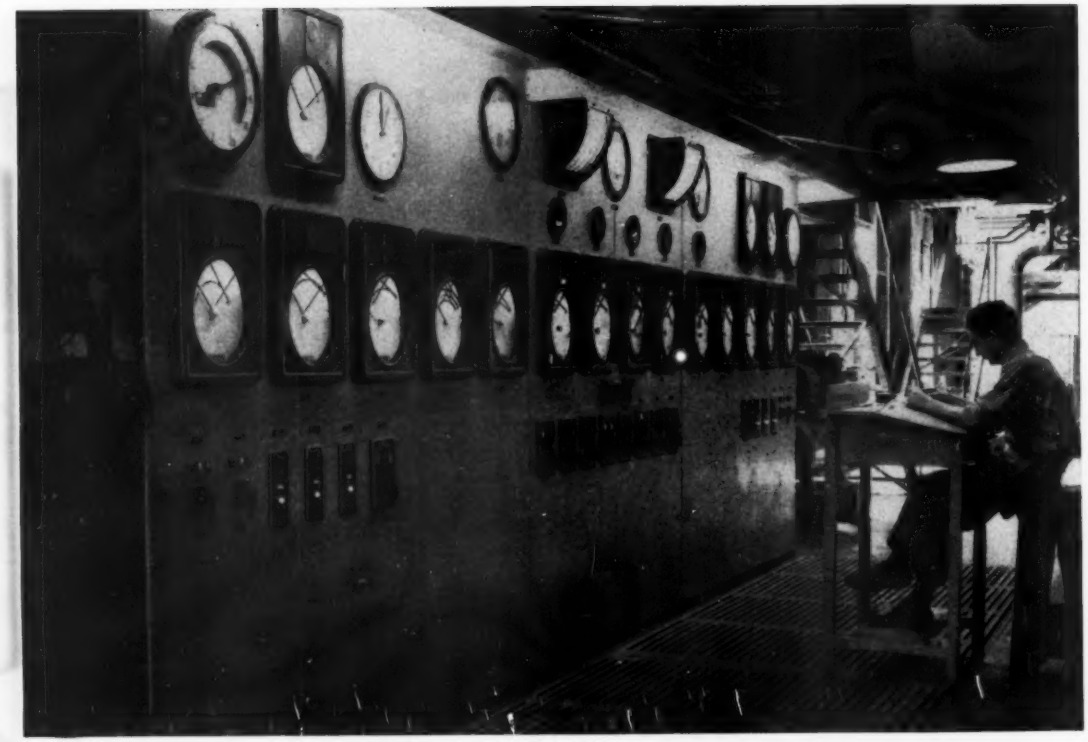
COMPANY

Ridgway Division—Ridgway, Pa.

DISTRICT OFFICES IN PRINCIPAL CITIES

L-809

What's YOUR Fuel-dollar



This Bailey Boiler Control Panel insures high efficiency in the use of Fuel-Dollars at a Western Chemical Plant. It includes Bailey Combustion Control, Bailey Three-Element Feed Water Control and Bailey Steam Pressure Reducing Control for two oil-fired boilers.

Controls for Steam Plants

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

Efficiency ?

A dollar's worth of fuel has the *same potential* energy, no matter who's boiler it fires. But how much of the energy actually gets converted to a usable form depends on how you operate your boiler.

That's where Bailey Controls can help. And, here's why, we believe, you'll get better fuel-dollar efficiency with Bailey:

1. **Complete Range of Equipment—fully co-ordinated.** You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, just because he has a limited line to sell—or that Bailey will pass the buck for efficient control; we offer *complete* boiler control systems.

2. **Engineering Service—backed by experience.** No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement and automatic control.

3. **Direct Sales-Service—conveniently located near you.** Bailey Meter Company's sales-service engineers are located in more industrial centers than those of any other manufacturer of boiler control systems; you get prompt, experienced service with a minimum of travel time and expense.

For better fuel-dollar efficiency—for more power per fuel-dollar, less outage and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey Engineer to arrange a visit to a nearby Bailey installation. We're proud to stand on our record: "More power to you!"

A-109

BAILEY METER COMPANY

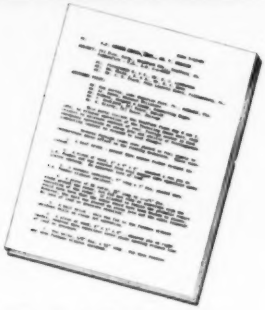
1036 IVANHOE ROAD • CLEVELAND 10, OHIO

BAILEY METER COMPANY, LIMITED • MONTREAL, CANADA

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

A group examines some of the foreign material used in a punishing test of the feeding mechanism of a Centrafire with Traveling Grate. The original demonstration was conducted at the Westinghouse Plant at Trafford, Pennsylvania, on May 8 and 9, 1950. If you would like to see this test repeated, ask your nearby Westinghouse Steam Specialist for a showing.



YOURS FOR THE ASKING

Send for the complete report on the Centrafire with Traveling Grate test. Books are also available on either the Traveling Grate or Link-Grate Centrafire Stokers. Write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

COULD YOUR STOKER PASS THIS TEST?

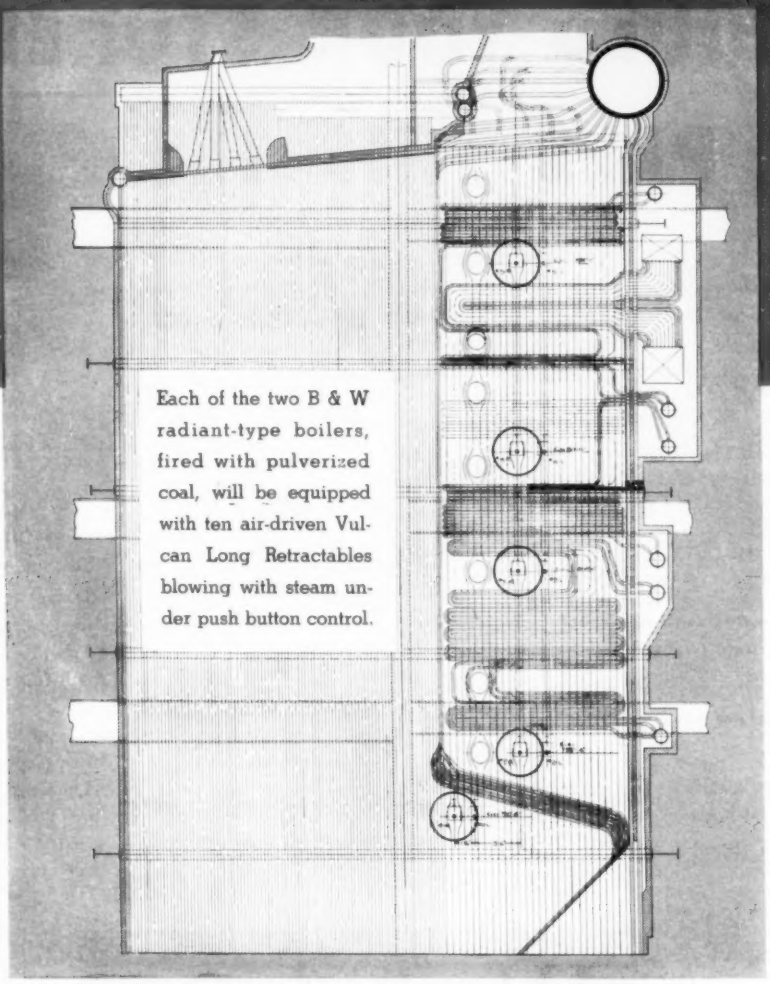
The ability of the Centrafire with Traveling Grate to "take it" and continue to operate without loss of load under extreme conditions has been repeatedly demonstrated in tests like this one. Wet fuel and extraneous matter were handled without interfering with operation. Tests such as this prove that Centrafire feeders are virtually non-stallable. The unusual or large obstruction that causes difficulty is quickly and easily removed. Read these excerpts from the actual test report:

- **A half brick**—passed through center feeder without incident on both rotor and steam-jet operation.
- **Blocks of wood**—of two sizes, both sheared pins in feeder, but were removed without loss of load or pressure.
- **Ceramic insulator**—passed through feeder without incident.
- **A piece of BX cable**—3½ feet long—wound around rotor, but did not stop or interfere with operation of the rotor.
- **Two bolts**—⅝" x 5½"—fed through feeders and into furnace without incident.
- **Steel cable**—forty-six inches of ½", fed through feeder endwise, worked through and into furnace without incident.
- **Market coal**—½" x 0", bone dry, was wet down at the coal conveyor and successfully fed into furnace without incident.
- **Extremely wet coal**—with continuous stream of water running out of all feeders—was fed with no adverse effect. Some wet coal accumulated on the feeder sills in the furnace but was easily removed with poker.

The outstanding performance of the Centrafire with Traveling Grate stems from features that are built in—not added as accessories. All moving elements are hydraulically operated by one turbine- or motor-driven oil pump. This assures infinite flexibility through the complete range of operation—synchronizes coal feed and grate speed. The Centrafire's range extends upwards of 300,000 lbs. of steam per hour. It will pay you well to get the full Centrafire Story.

J-50513

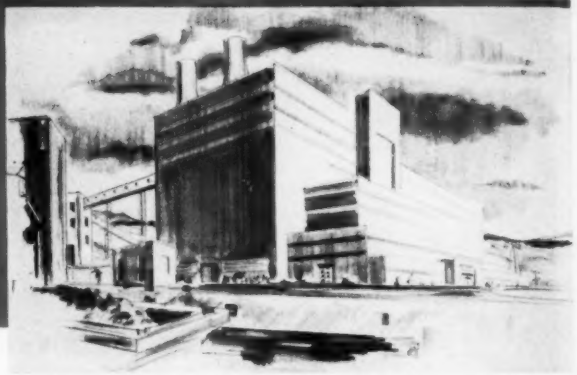
It's VULCAN *at*



Each of the two B & W radiant-type boilers, fired with pulverized coal, will be equipped with ten air-driven Vulcan Long Retractables blowing with steam under push button control.

VULCAN *Automatic*

ELRAMA POWER STATION
4th VULCAN SYSTEM
for
DUQUESNE LIGHT COMPANY



ELRAMA POWER STATION, DUQUESNE LIGHT COMPANY

FOR the fourth time in its $112,000,000 post-war expansion and construction program, Duquesne Light Company has ordered Vulcan Automatic Soot Blowers. This latest order is for the new Elrama Power Station near Clairton, Pennsylvania, which will add 190,000 kilowatts to the system generating capacity. Each of the two Babcock & Wilcox radiant-type boilers will have a capacity of 900,000 pounds of steam per hour at 1350 psi and 950 degrees F. Each will have ten air-driven Vulcan Long Retractables, blowing with steam under push button control. The swing to Vulcans continues, as alert engineers learn that Vulcan cleans better and costs less to maintain.

VULCAN SOOT BLOWER DIVISION

Continental Foundry & Machine Company

DUBOIS, PENNSYLVANIA

WITH NEW ILLUMINATOR ON YARWAY FLAT GLASS GAGE . . .

BOILER WATER LEVEL *Shines*

It's light! It's bright! It's right! You see instantly the accurate boiler water level in your Yarway Flat Glass Gage because *the meniscus at water level stands out like a brilliant star* . . . thanks to the new Yarway Type "M" Illuminator.

The Type "M" Illuminator is specially-designed to give maximum brilliance to Yarway flat glass inserts, and to spot the water level over its entire traverse. The superior penetration of its blue-white light cuts through extraneous light, dust particles in the air, and deposits on the gage glasses. Effective over longer distances.

New or already-installed Yarway Flat Glass Gages may be equipped with the Illuminator. Yarway Illuminators may be installed in pairs on four-glass gages.

Get in touch with your nearest Yarway office for further details on this latest Flat Glass Gage development, or write direct to . . .

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

A COMPLETE YARWAY WATER LEVEL SYSTEM

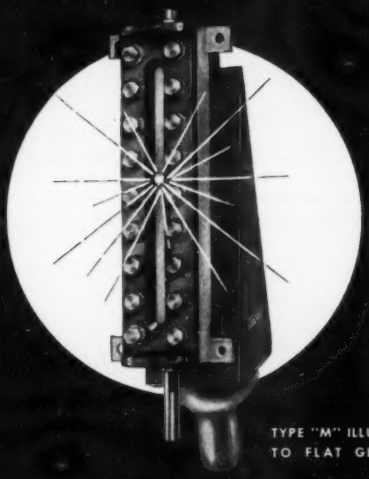
AT THE BOILER ROOM (*Left*) Yarway Pioneer Hi-Lo Alarm Water Column with Vertical Pressure-Sealed Flat Glass Gages. Equipped with Type "M" Illuminator. See Bulletin WC-1812.

ON THE INSTRUMENT PANEL (*Left*) Yarway Remote Liquid Level Indicator, operated directly by the boiler water head, indicating mechanism is never under pressure—no stuffing boxes. See Bulletin WG-1322.

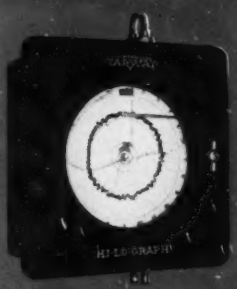
(*Right*) Yarway Hi-Lo Graph Recorder provides not only instant indication but also 24-hour recording of boiler water levels. See Bulletin WG-1830.

YARWAY STEAM

like a Star



TYPE "M" ILLUMINATOR ATTACHED TO FLAT GLASS GAGE INSERT



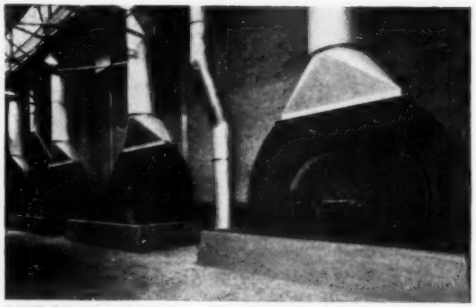
IN THE PLANT
Yarway Remote Hi-Lo Alarm Signals—lights or horns. Operated by Control Unit available with Remote Liquid Level Indicator or Recorder. See Bulletin WG-1811.

PLANT EQUIPMENT

G-E SYNCHRONOUS

SAVE MONEY

SAVE ON OPERATING COSTS . . . Municipal plant gets higher efficiency by continuous operation at constant speed of three 500 horsepower, 1.0 power factor, G-E synchronous motors, each coupled to a centrifugal storm-sewer pump.



SAVE ON INITIAL COST . . . Paper mill selected this 4000 hp, 200 rpm, G-E synchronous motor for driving the montague grinders at low speed. Maximum operating efficiency thus resulted.

GENERAL ELECTRIC

720-22

MOTORS CUT COSTS
. . . improve performance

IT'S ON THE RECORD . . .

Lower operating costs higher operating efficiency

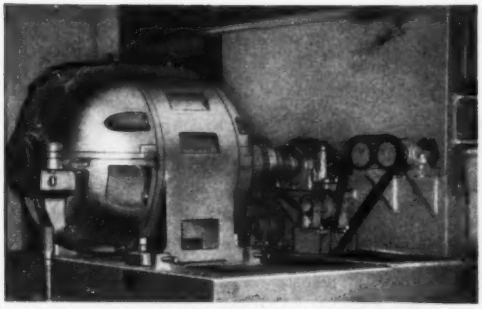
Lower initial cost including control and exciter—for many ratings

Reduced demand and release of needed generating capacity

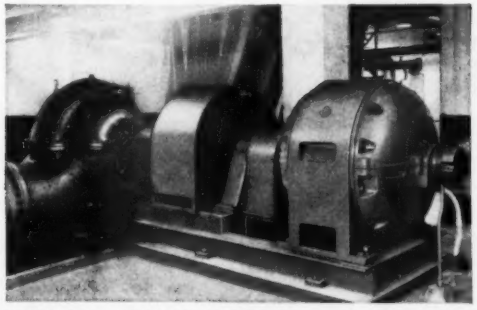
Reduced power rates for improved power factor

For your next large, constant-speed motor, ask your General Electric sales representative to tell you how you can take full advantage of the money-saving features of G-E SYNCHRONOUS MOTORS. Or write for bulletins GEA-5332 (low-speed) or GEA-5426 (high-speed) on your letterhead to *Section 770-22, Apparatus Department, General Electric Company, Schenectady 5, New York.*

GAIN EXTRA PERFORMANCE

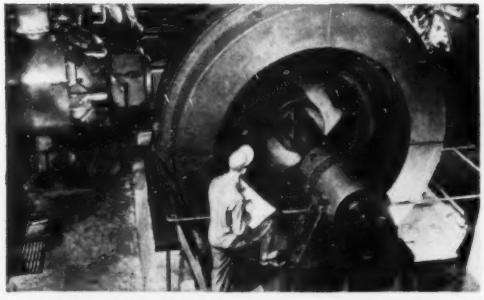


DEPENDABILITY . . . Extra protection against physical damage, electrical breakdown, and operating wear and tear makes Tri-Clad® motors highly suitable for sawmill operations. Here is a Tri-Clad synchronous motor rated 300 hp, 1200 rpm, driving an edger in an Oregon sawmill.



LONG LIFE . . . All welded steel-plate stators assure a permanently solid core, and box-type construction means a rigid frame. This 350 hp, 0.8 p.f. G-E synchronous motor, coupled through magnetic clutch, is matched to a fan pump which delivers stock to paper machine.

SIMPLIFY OPERATING PROBLEMS



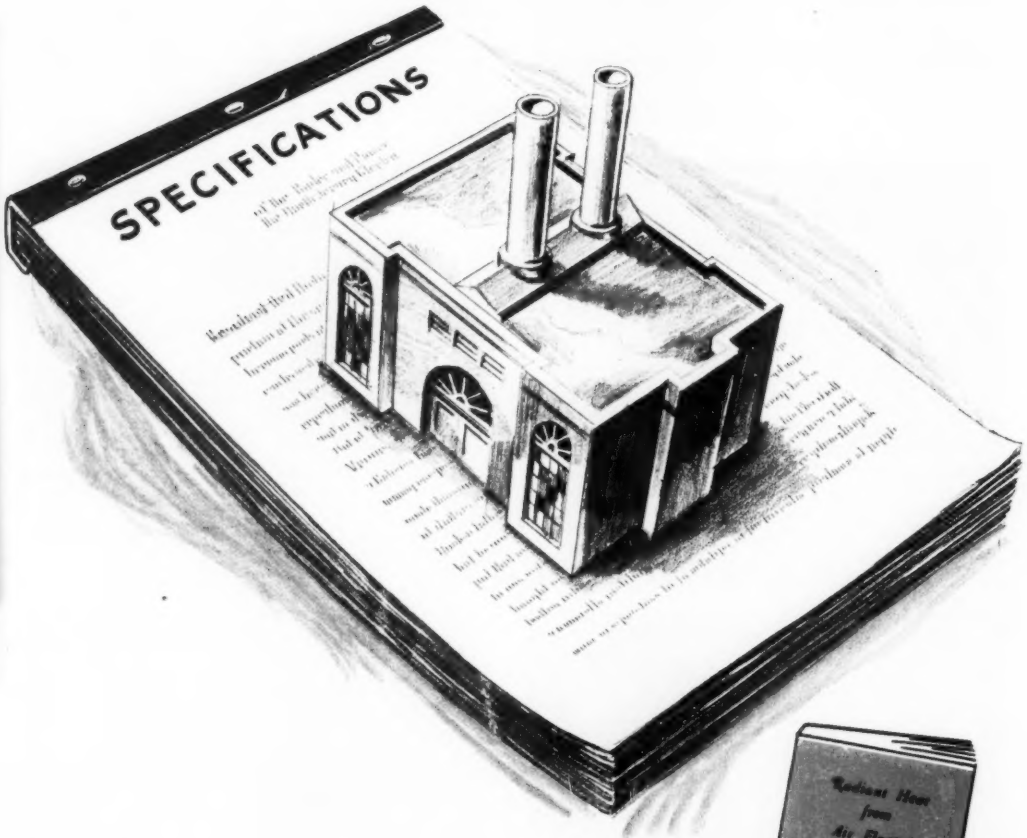
APPLICATION ENGINEERING . . . Engineers with many years of field experience will tailor synchronous motors to fit your needs. An example is this largest synchronous motor (in horsepower) ever to be applied to drive a reciprocating compressor; G-E motor rated 4500 hp, 300 rpm, driving a Clark gas compressor.

®Reg. U. S. Pat. Off.

SERVICE . . . No matter where your plant is located, you will find General Electric service close at hand. Experienced engineers of our local offices, and trained staffs from our Service Shops are always at your command.

You specify the conditions

KVS WILL DESIGN...



Send for a copy of 97-page Engineering Bulletin No. 44-B containing valuable information on steam generation and coal preparation.

... AND BUILD THE PLANT...

Anywhere **COMPLETE** *from "Bunker to Bus Bar"*

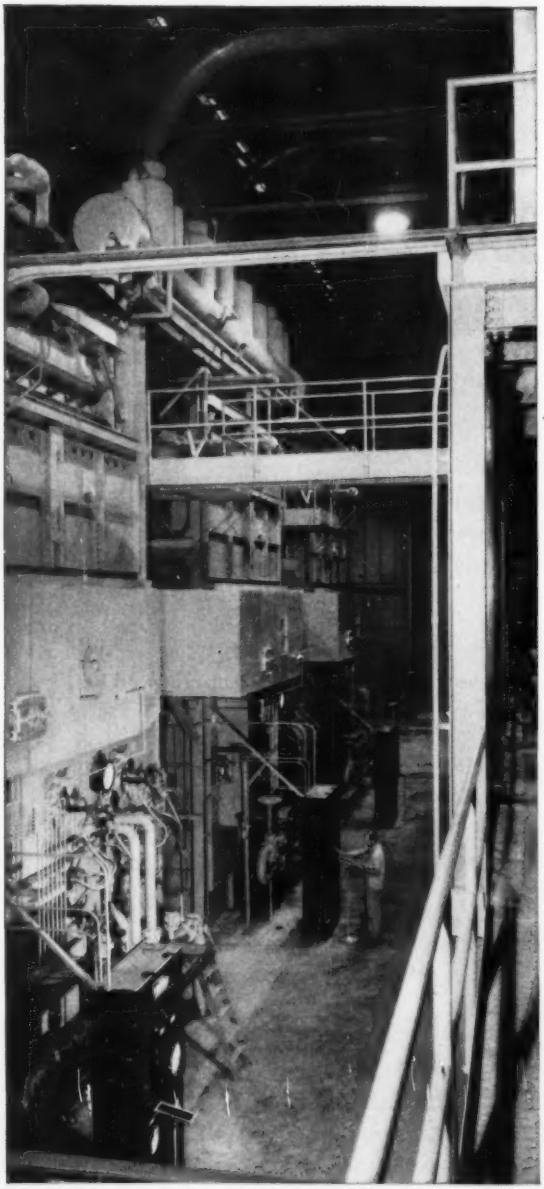
REGARDLESS of where your contemplated plant is to be located, KVS will design, build and erect it complete with all components for operation on low grade fuels. KVS will also help with preparation of specifications so that all details will be taken care of in advance of erection.

The fact that KVS equipment is designed for steam production from such fuels as tailings, screenings, washings, etc. means that the cost per KW of power produced in a KVS-built plant will be the lowest possible.

In making this complete service available in any part of the world, KVS assumes full responsibility for the performance of the plant, the meeting of guarantees and its adequacy for the conditions under which it is to operate and which dictated its design. All components, whether or not built in KVS shops, which go to make up the complete plant, will be furnished by KVS.

Outline your conditions and call on KVS for assistance in meeting them.

COMBUSTION CONTROL



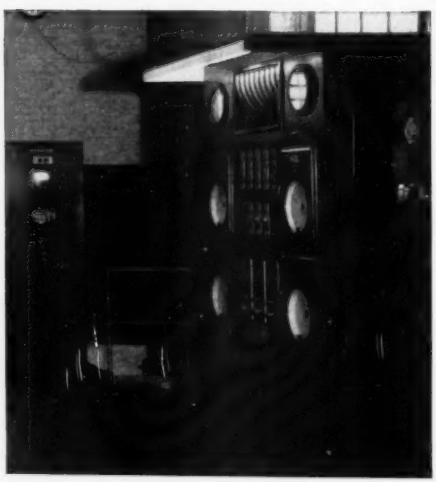
FOR
ALL SIZES OF BOILERS
ALL TYPES OF FIRING
ALL LOAD CONDITIONS

An automatic combustion control system, as designed and built by Republic, will enable you to operate your boiler (or boilers) over a long period at test efficiencies regardless of variations in fuel, load and other operating factors.

Republic combustion control is a unified system controlling simultaneously, in measured quantities and in correct proportions, the fuel and air input to the boiler.

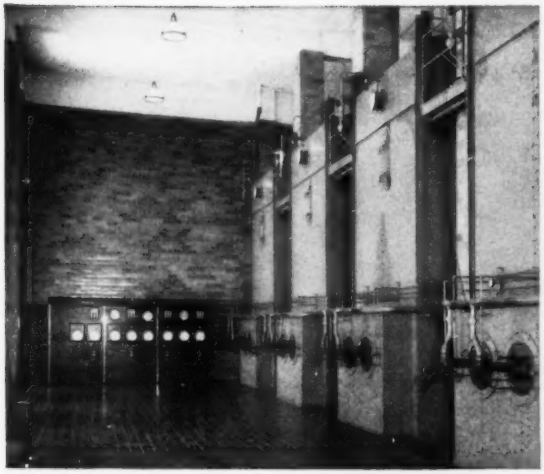
It automatically increases or decreases the fuel and air supply to the boiler in the correct amount to maintain constant steam pressure and in the correct ratio to maintain maximum combustion efficiency.

Republic automatic combustion control systems, either pneumatic or hydraulic, are available for all sizes of boilers, all types of fuel firing, and load conditions and any arrangement of draft equipment. They are completely described in Data Book No. S-21—write for your copy.

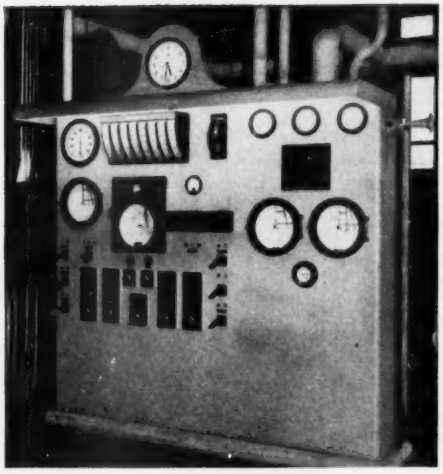


GAS FIRED—In this modern industrial plant steam is generated at the rate of 400,000 lbs. per hr. by four gas fired boilers operated by a Republic automatic combustion control system.

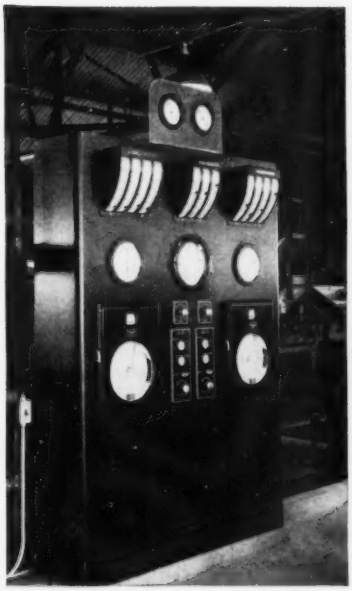
STOKER FIRED—The Republic instrument and combustion control panel for an 80,000 lbs. per hr., stoker fired boiler in a municipal power plant.



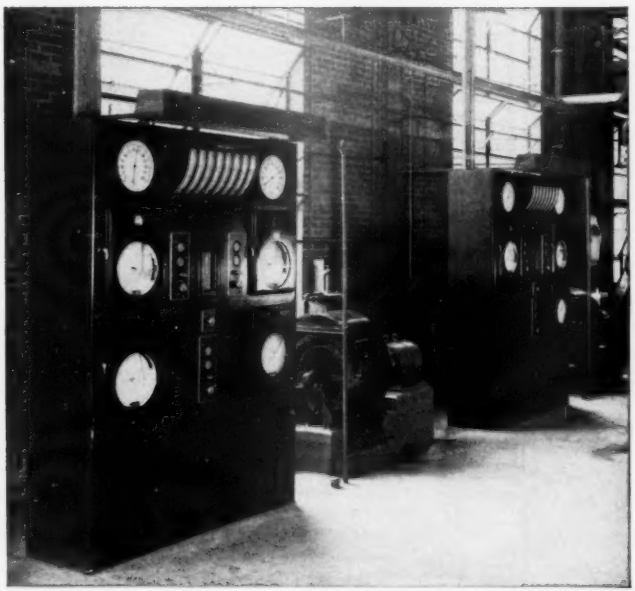
OIL AND GAS FIRED—In this model boiler room of a large institution the four combination oil and gas fired boilers are operated by a Republic automatic combustion control system.



STOKER FIRED—The Republic combustion control and instrument panel for the automatic operation of a 45,000 lbs. per hr. stoker fired boiler.



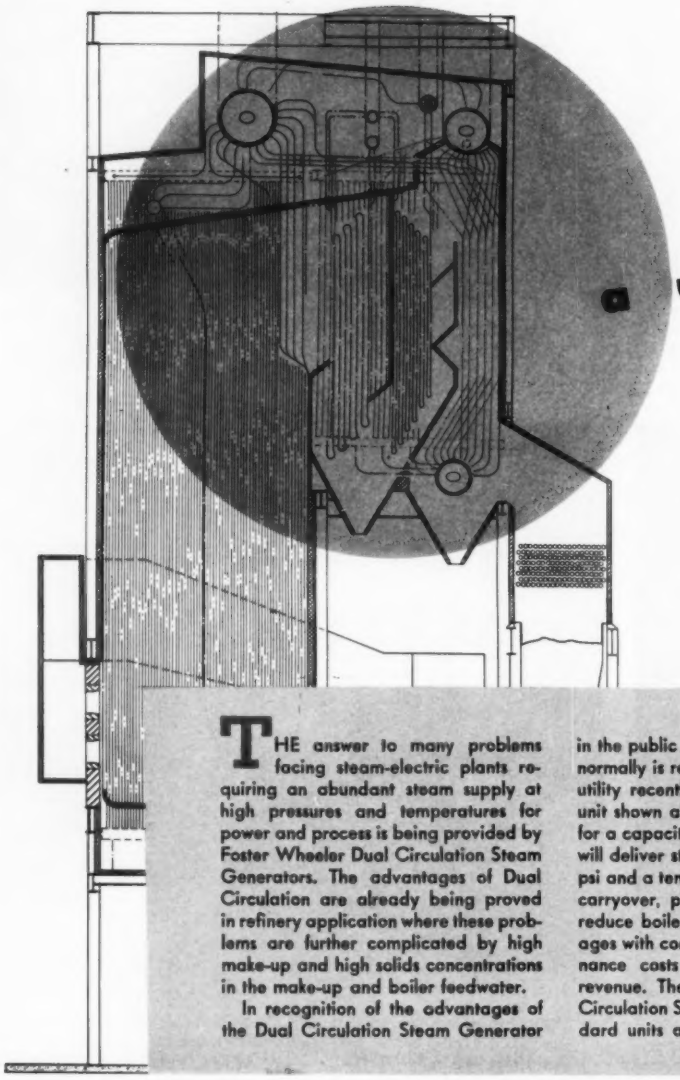
MIXED GAS—Republic instrument and control panel installed in a natural gasoline plant to automatically control two 50,000 lbs. per hr. boilers burning mixed gas.



STOKER FIRED—A typical Republic combustion control installation in the boiler room of a mid-western university for the automatic operation of two 25,000 lbs. per hr. stoker fired boilers. All boiler instruments and manual controls are centralized on the two panels pictured above.

REPUBLIC FLOW METERS CO.

2240 Diversey Parkway, Chicago 47, Illinois



a utility

THE answer to many problems facing steam-electric plants requiring an abundant steam supply at high pressures and temperatures for power and process is being provided by Foster Wheeler Dual Circulation Steam Generators. The advantages of Dual Circulation are already being proved in refinery application where these problems are further complicated by high make-up and high solids concentrations in the make-up and boiler feedwater.

In recognition of the advantages of the Dual Circulation Steam Generator in the public utility field where make-up normally is relatively low, a midwestern utility recently ordered the three-drum unit shown above. This unit is designed for a capacity of 425,000 lb per hr and will deliver steam at a pressure of 1350 psi and a temperature of 955 F. The low carryover, previously unattainable, will reduce boiler and turbo-generator outages with consequent savings in maintenance costs and gains in operating revenue. The advantages of the Dual Circulation Steam Generator over standard units are illustrated at the right.

● *Write for a Copy of Bulletin B-50-11*

FOSTER WHEELER CORPORATION 165 BROADWAY NEW YORK 6.

specifies... DUAL-CIRCULATION

REDUCED CARRYOVER OF

a. Silica
b. Total Dissolved Solids

LOW CONCENTRATION IN HIGH DUTY FURNACE SECTION RESULTING IN

a. Minimum Tube Damage
b. Reduced Maintenance and Outage Time

IMPORTANT SUPPLEMENTARY ADVANTAGES IN CERTAIN APPLICATIONS

a. Reduced Blowdown With Resulting Reduction In Heat Loss and Size of Heat Recovery Equipment

b. Reduced Cost of Chemicals and Equipment For Water Treatment

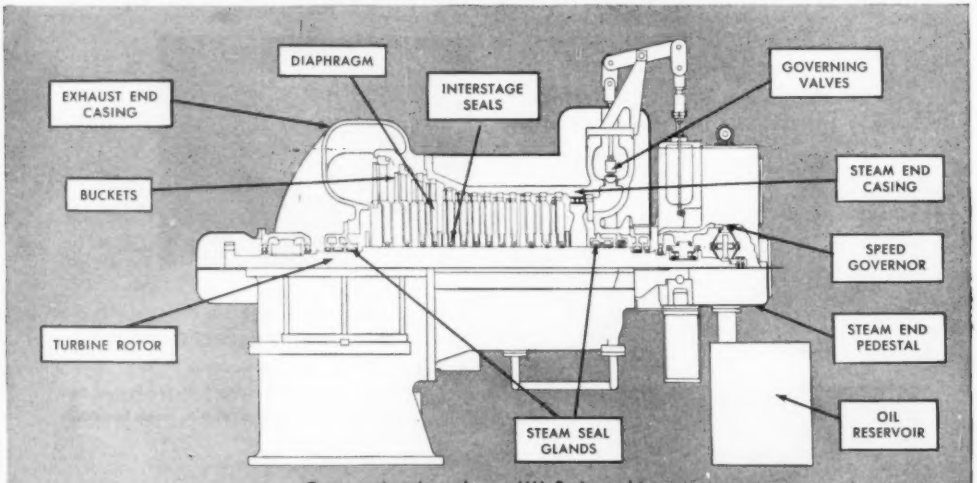
NEW YORK

FOSTER WHEELER

Allis-Chalmers

the WA

A Fully Modern Turbine Generator



Cross-section through new WA-Series turbine.

Silhouette of new WA-Series steam turbine generator unit.

Announces...

WA Series

Line of Steam Units; 500-7500 Kw

NOW IN PRODUCTION at Allis-Chalmers is the WA-Series of all-impulse steam turbine generators . . . embodying the most recent design developments! This series covers NEMA ratings in the range from 500 to 7500 kw inclusive. They are being built for both condensing and non-condensing service, with or without automatic extraction.

The WA-Series brings to the industrial and utility power plant the economies of repetitive manufacture as well as the design refinements proved in the larger units. The WA-Series incorporates flexibility of design to meet a wide variation of application requirements.

This modern design combines the very newest developments in impulse turbines and self ventilated generators. Allis-Chalmers—builder of steam prime movers for over 80 years and turbine builder for nearly half a century — has units of all types, and up to 150,000 kw in service.

The WA-Series units are functionally attractive and will be the central feature of any power plant. Turbine, generator and exciter are all especially engineered to operate together. The entire unit is designed, manufactured, assembled, and tested under one supervision at one plant.

For top performance in generation, with or without the economies of by-product steam, investigate the features of the new WA-Series. Be sure your next turbine generator has *all* the latest features!

Contact your nearest Allis-Chalmers office for full information on the advantages a WA-Series 500 to 7500 kw turbine generator will bring to *your* power plant. Main offices at Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

TURBINES & GENERATORS • CONDENSERS & PUMPS • MOTORS & CONTROL
SWITCHGEAR & BREAKERS • TRANSFORMERS • WATER CONDITIONING

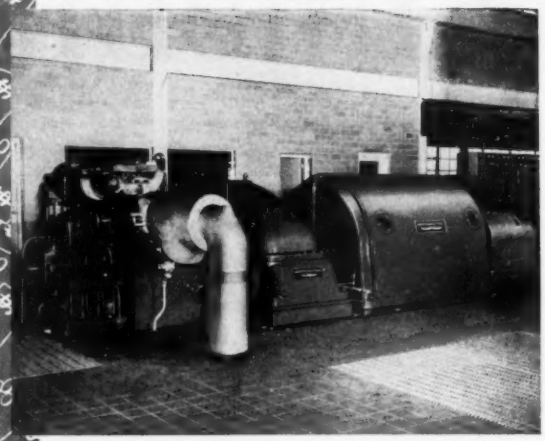
World's Widest Range of Power Plant Equipment

A-3233

FACTS ABOUT THE

Most Profitable Turbine Generator Investment

YOU CAN MAKE...



One of two Worthington 4000 kw turbine generator sets installed in a mid-western municipal power plant, operating on 600 #G and 750 F.T.T. Steam exhausting to 28" Hg vacuum.

Worthington's Experience and Undivided Responsibility Assure Low Cost, Dependable Power

Builders of steam turbines for over 30 years, Worthington's Steam Turbine Division is backed by the experience and resources of the entire Worthington organization — recognized leaders in the power plant field for more than a century. In view of today's increased turbine pressures and temperatures — and the resulting needs for new and special materials — this vast, combined source of technical knowledge has proved of tremendous practical value in developing turbine design, construction and performance.

Generators Are Worthington's, Too

The generators used with Worthington Turbines are built by a Worthington subsidiary that has specialized in this field for over 45 years. This means that Worthington, as manufacturers of *complete* turbine generator units, assumes *undivided responsibility* for the coordinated design, assembly and performance of these units.

Before shipment, Worthington Turbines and Generators are assembled together *as units* for testing and adjustment — eliminating the necessity for doing this after installation. Also, for installation and service, Worthington turbine specialists and regular Worthington service men are always available from our District Offices throughout the country.

Check These Over!

Adding up, Worthington's matchless power plant experience . . . huge manufacturing facilities . . . long specialization in both turbine and generator manufacture . . . undivided unit responsibility . . . and skilled technical service . . . are the best assurance you can get anywhere of efficient, economical steam turbine power.

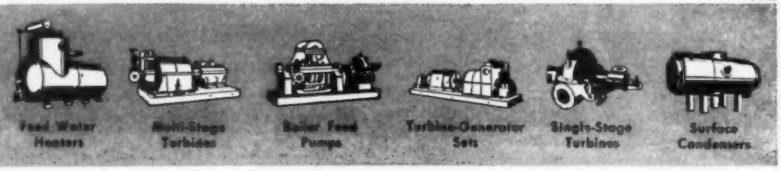
Worthington makes turbines in a wide range of sizes and types, each one designed to make steam do more work. For details proving *there's more worth in Worthington*, contact your nearest Worthington representative. Or write to *Worthington Pump and Machinery Corp., Steam Turbine Division, Wellsville, N.Y.*

WORTHINGTON

STEAM TURBINES

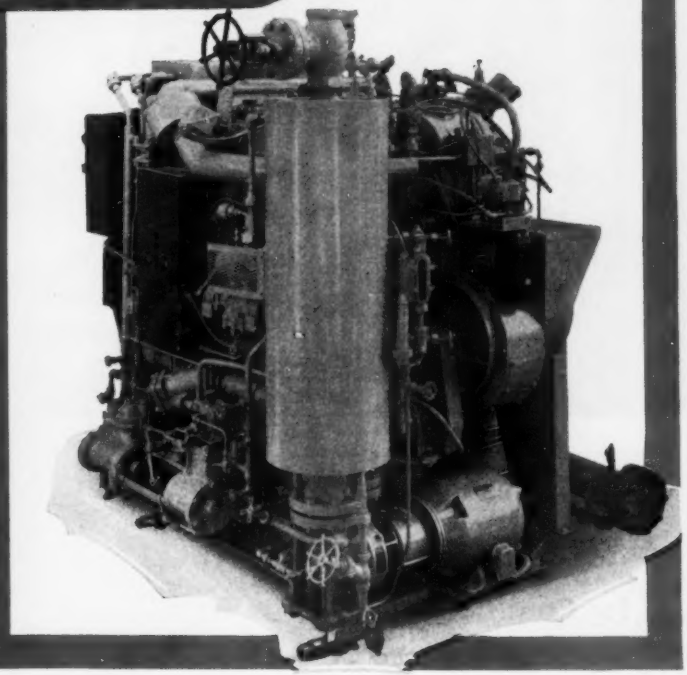
TO.2

A GREAT TEAM IN STEAM



Not a Package Boiler—but a PACKAGED STEAM PLANT

Compact -Reliable -fully Automatic



C-E RE-CIRCULATION STEAM GENERATOR Unit shown at the right is the 6,000 lb of steam per hr size; occupies a space 6'-11" long x 5'-5" wide x 6'-11" high. Other standard sizes — 2500 and 4000 lb of steam per hr.

Do you need steam . . .

. . . for heating, processing or both – in unit capacities up to 6,000 pounds per hour – for pressure up to 300 psi?

. . . in remote locations involving the expense of installing and maintaining long insulated pipe lines?

. . . for intermittent requirements—a few hours each day or week?

. . . for an occasional load which may exceed the capacity of existing boilers?

. . . for a highly fluctuating load which involves sudden heavy demands?

. . . with completely automatic operation; with a minimum of attention necessary?

. . . at maximum output from minimum space?

If you do—if you have any one or a combination of these requirements—your best bet is the C-E Re-circulation Steam Generator . . . more than a package boiler . . . a complete steam plant, including all controls and auxiliaries in a fully integrated unit. Send for bulletin p-323.

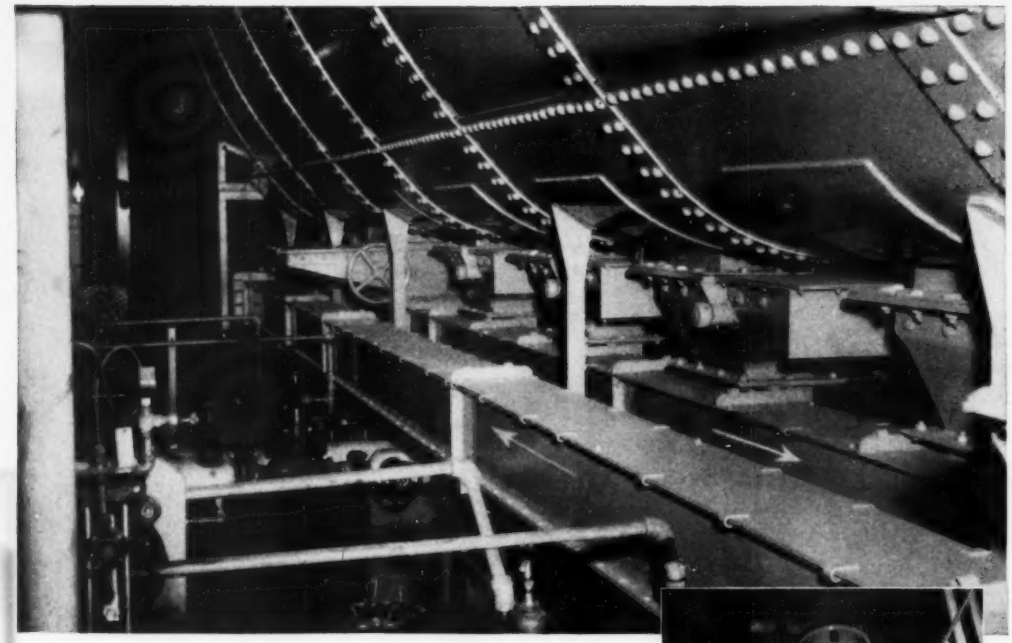
B-458

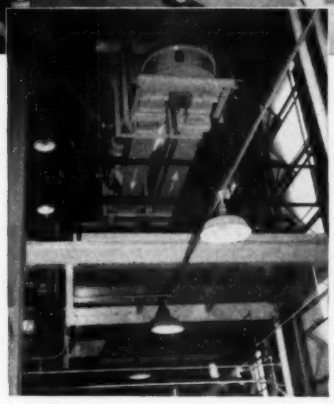
C·E

COMBUSTION ENGINEERING – SUPERHEATER, INC.

200 Madison Avenue, New York 16, N. Y.

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS





"SPECIAL DELIVERY"
"SPECIAL HANDLING"

for Coal Conveying at
AMERICAN TOBACCO CO.

Keeping a boiler house as neat as your wife's kitchen was one aim in designing this installation. It was achieved by a horizontal S-A REDLER Conveyor, mounted high up under the bunker, requiring no floor space.

But two important special requirements were also met: 1st, "special delivery" of every pound of coal from bunker to scales from any part of the bunker—no dead storage areas; 2nd, "special handling" from eleven gate-controlled bunker outlets to the enclosed dust-confining REDLER. In a closed circuit, coal circulates to discharge as needed at two scales and then by gravity directly into boiler stokers at floor level.

Such careful experienced design of coal and ash handling systems can be expected of Stephens-Adamson because of the complete line of equipment and half-century experience behind the engineering staff. When you think of any change in your present layout or operation, think of S-A. Write us for recommendations.

1901-1951

50 years experience with bulk handling

STEPHEN S-A ADAMSON MFG. CO.

5 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif. • Belleville, Ontario

AMERICAN TOBACCO CO.
LOUISVILLE, KY.

Totally enclosed REDLER Conveyor 52 ft. long with 180° bend corners runs in a closed circuit directly below high bunker. S-A totally-enclosed gates at eleven chutes reclaim all coal from any part of long bunker to one run of the REDLER. Circulating until called for, coal then drops from either of two gate-controlled outlets to scales. Advantages: Dead storage areas eliminated—dust is kept within REDLER casing, boiler house clean—all coal continuously available—compact installation with minimum alteration of existing structures.

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

Remember—only genuine **TUBE-TURN Welding Fittings are identified by these trade marks!**

tt and TUBE-TURN are trade marks of Tube Turns, Inc.

Unique forging process gives strength

TUBE-TURN WELDING FITTINGS have a close-grained metal structure fully as strong as the pipe to which they are welded. Welding elbows, for example, are forged by the only process that achieves wall thickness as uniform as the original seamless pipe . . . guaranteeing *full strength throughout*. And, their true circularity means accurate alignment, regardless of angle, for strong, tight, permanently leakproof connections.

Forged-in strength is inherent with all types of TUBE-TURN Welding Fittings. It's one of the big reasons why it pays to specify them for *all* jobs. Get in touch with your nearby TUBE TURNS' Distributor. You'll find one in every principal city.

Write Dept. C-2 for free booklet giving Dimensional Data on types, sizes and materials of TUBE-TURN Welding Fittings and Flanges.

"Be sure you see the double tt*"*

TUBE TURNS, INC. LOUISVILLE 1, KENTUCKY

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Houston • Tulsa • San Francisco • Los Angeles

TUBE TURNS OF CANADA LIMITED, CHATHAM, ONTARIO . . . A wholly owned subsidiary of TUBE TURNS, INC.

Wrought iron downspout welded on Cleveland Bridge

Cleveland's Abbey Avenue Bridge is big enough to collect a lot of water in a rainstorm. To get rid of it, nine downspouts, ranging from 39 to 66 feet in height, carry the water to underground sewers. Wrought iron pipe was chosen for its resistance to rust. All-welded piping was chosen for long life, structural rigidity. Weak joints here could be fatal!

Contractor on this job, the Gorman-Lavelle Company of Cleveland, likes speed on the job. The piping itself was quickly fabricated on the ground, then raised into position. Piping went up fast—and safely!

A lateral connection near the top of the spout leads up to drains on the bridge. TUBE-TURN Welding Reducers are installed at the very top of the spout. The drain sets in the reducer with a loose fit, allowing 2" clearance all around. Thus the bridge can expand on its roller bed without disturbing the pipe. TUBE-TURN Welding Reducers, Elbows, Laterals and Caps are all part of the leading line in welding fittings.

DISTRICT OFFICES
New York
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TUBE TURNS, INC.
LOUISVILLE, KENTUCKY

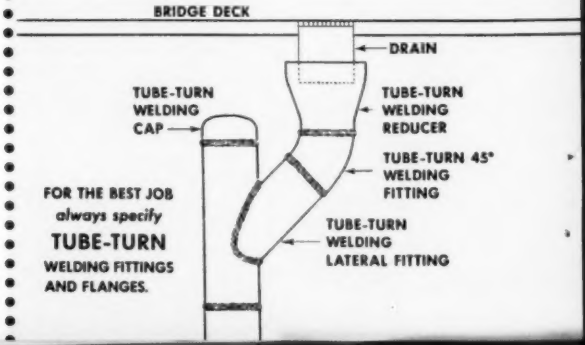
Note TUBE-TURN Welding Elbow at bottom of downspout. Drain pipe will be connected to underground sewer. Underground, too, a system welded with TUBE-TURN Welding Fittings is the best long-term bet—there are no threads to corrode, the problem of leakage is eliminated.

Want dimension data?

Valve dimensions, too, are unrolled a handy flatter of steam valve dimensions, and weights of TUBE-TURN Welding Fittings and Flanges. If you'd like a free copy just send the coupon.

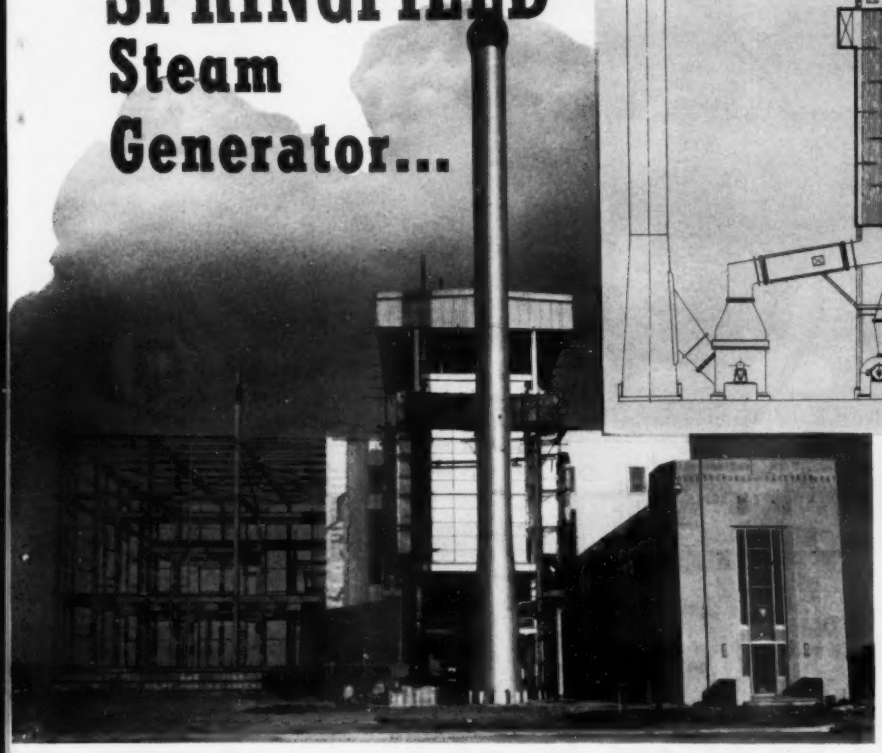
TUBE TURNS, INC., Dept. C-2
224 East Broadway, Louisville 1, Kentucky

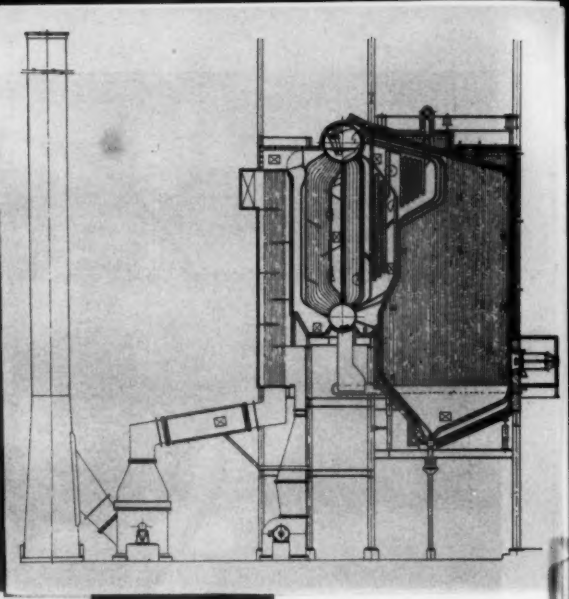
Your Name .....
Position .....
Company .....
Nature of Business .....
Address .....
City ..... *State* .....



FOR THE BEST JOB *always specify* **TUBE-TURN** WELDING FITTINGS AND FLANGES.

Another New
SPRINGFIELD Steam Generator...





Location:
W. R. (Bob) Poage Steam Plant
Belton, Texas

Consulting Engineers:
Laramore & Douglass, Inc.
Chicago, Illinois

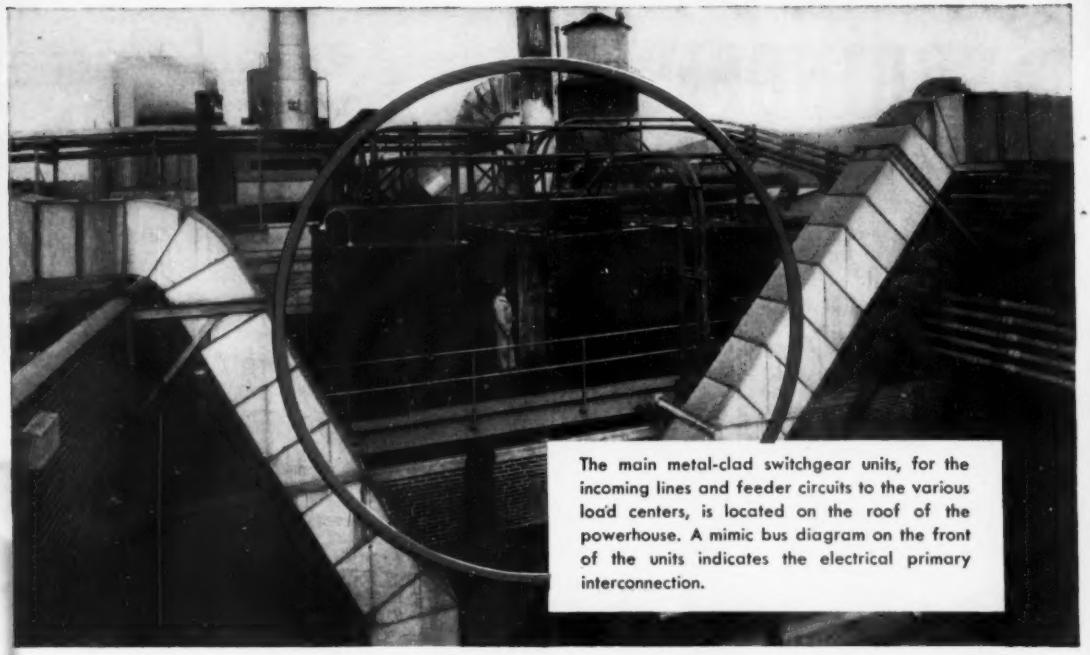
2nd Unit being added to W. R. (Bob) Poage Steam Plant

SPRINGFIELD *again* is the choice for the second steam generating unit of the W. R. (Bob) Poage Steam Plant located near Belton, Texas! Like the first generator, the second is a modern, two-drum, bent tube Springfield design arranged for outdoor installation in front of the partially completed structure appearing at the left in the above photograph. Complete with superheater and air heater, it will handle loads ranging from 60,000 to 130,000 lbs. of steam per hour at 630 psig operating pressure with 825°F. total steam temperature at superheater outlet. Firing is with natural gas or oil.

Springfield specializes in the production of modern steam generating equipment . . . ANY SIZE . . . ANY PRESSURE . . . ANY TEMPERATURE . . . AND FOR ANY FUEL. Springfield is organized to apply the same *engineering skill* to all contracts, large or small. *We will be glad to submit a proposal covering your requirements.*

Check with Your Consulting Engineer on Modernization and New Plant Projects

SPRINGFIELD BOILER CO.



The main metal-clad switchgear units, for the incoming lines and feeder circuits to the various load centers, is located on the roof of the powerhouse. A mimic bus diagram on the front of the units indicates the electrical primary interconnection.

PUTS SWITCHGEAR ON ROOF

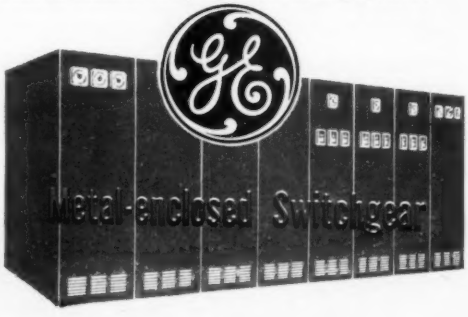
saves 10,000 sq. ft. of floor space

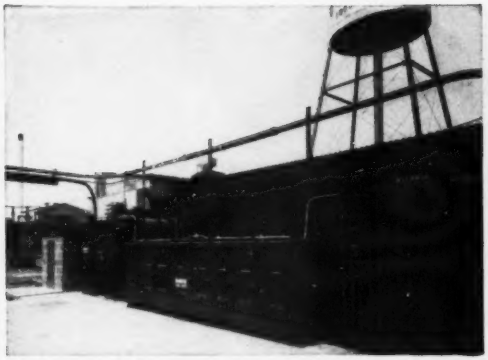
Indoor space limited—installation made with almost no interruption of production —Maintenance will be greatly simplified.

When Scott Paper Company, of Chester, Penna., completely revamped its electrical system to take care of expanded plant output, it made one rather unusual decision. Because indoor space was limited, it put all its switchgear and load-center units on the roofs of the various buildings. The incoming utility power lines, at 13,200 volts, terminate in General Electric outdoor metal-clad switchgear on the roof of the powerhouse, and the 575-volt distribution system is fed through G-E metal-enclosed gear located on roofs of the individual buildings. Distribution between buildings is at 13,200 volts with step-down load-center units.

This type of installation has proved to have a number of advantages. In the case of Scott Paper, 10,000 square feet of badly needed floor space became available for paper making. The entire installation could be made during normal working hours, yet did not interfere with plant production. Likewise, routine inspection and maintenance can be done without entering the manufacturing areas. All breakers are of the easily-removable type that is so easy to maintain and inspect.

What's more, there's plenty of space for expansion. Provision has been made to double the capacity—by adding transformers and switchgear—when still more electric power is needed later. ***Apparatus Department, General Electric Company, Schenectady 5, N. Y.***

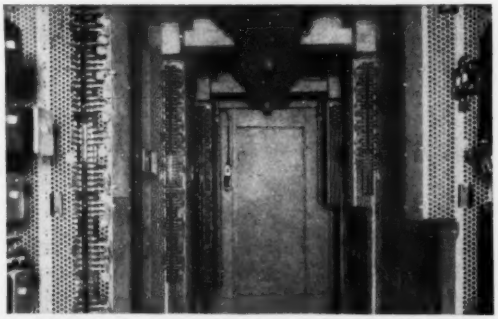


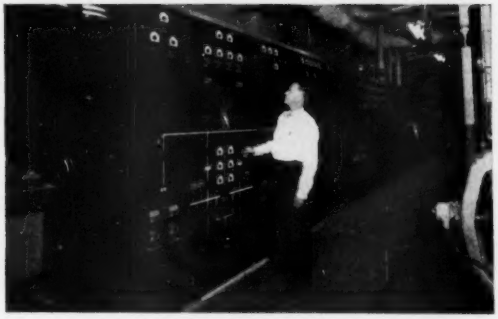


A double ended load-center unit feeding the large 2300-volt motors in one of the main buildings. Unit consists of two power transformers with air-interrupter disconnects, and metal-clad switchgear units for metering and for the four magne-blast air circuit breakers.

One of several single-ended load centers, which can be doubled in capacity later by adding a second transformer and low-voltage switchgear units. This particular unit uses metal-enclosed gear with draw-out air breakers to 575-volt feeders which serve the paper finishing units.

New switchboards simplify control — Increase safety



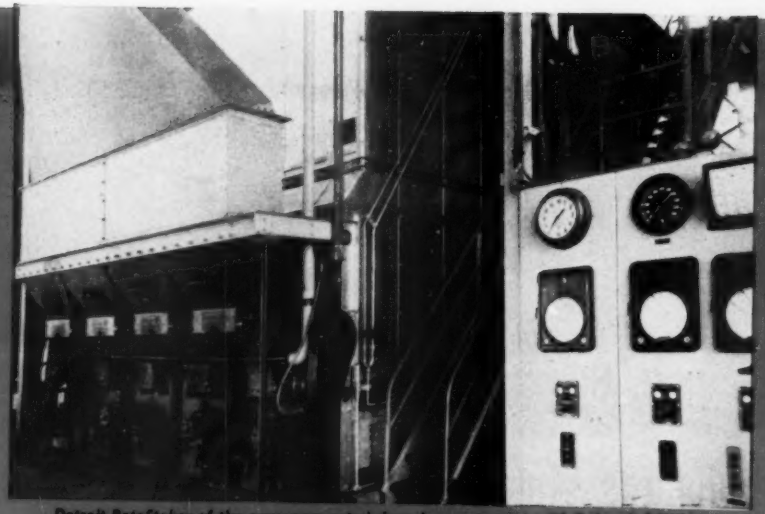


BEFORE Front and rear views of the old switchboard which handled all the plant's power at 575 volts. Open buses, breakers, knife-switches, and resistors were a definite hazard—and one bad short circuit or fire could have closed down the plant.

AFTER Main switchboard is now simply a control board. Incoming line and feeder circuits can all be closed from this one location. No power lines or high voltage is brought to this board at all—and there are no open buses or switches to form a hazard to personnel.

854-33

GENERAL ELECTRIC



Detroit RotoStoker of the power operated dumping grate type with Babcock & Wilcox FJ Boiler—Capacity 70,000 pounds.

DETROIT ROTOSTOKER

Handles widely and rapidly fluctuating load with uniform pressure

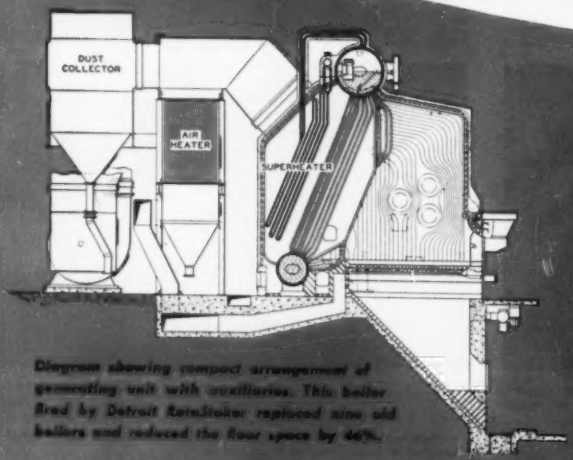
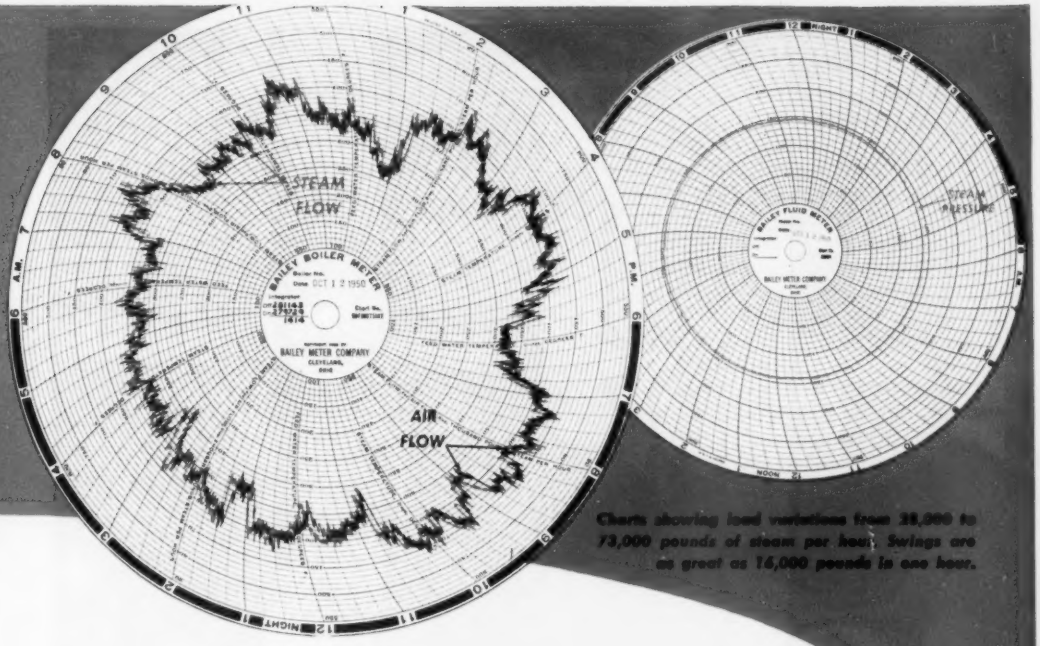


Diagram showing compact arrangement of generating unit with auxiliaries. This boiler fired by Detroit RotoStoker replaced nine old boilers and reduced the floor space by 66%.

Furnace interior showing dumping grates of the Detroit RotoStoker and emergency burners in side-wall for oil or gas.



Charts showing load variations from 38,000 to 73,000 pounds of steam per hour. Swings are as great as 16,000 pounds in one hour.

at Kerr Bleaching & Finishing Works, Inc.

CONCORD, N. C.

Detroit RotoStoker with Babcock & Wilcox boiler effects

40% Fuel Saving . . . 50% Labor Saving . . . 46% Less Floor Space

Fuel, labor and floor space savings were outstanding in this new Bleaching and Finishing Company boiler plant. A single boiler of 70,000 pounds of steam per hour maximum capacity replaced nine old boilers. The Detroit RotoStoker supplied the modern firing method which saved both fuel and labor.

As is common with heavy users of process steam, demands vary widely and rapidly. Often the variation in one hour will amount to as much as 16,000 pounds. Steam pressure remains steady.

The Detroit RotoStoker is a modern spreader stoker. It efficiently burns any type of Bituminous coal. By means of automatic regulation of fuel feed and air supply, fluctuating loads are easily handled.

Write for catalog on Detroit RotoStokers. They are available in many sizes to fit the furnace and load—with stationary, hand dumping or power dumping grates.

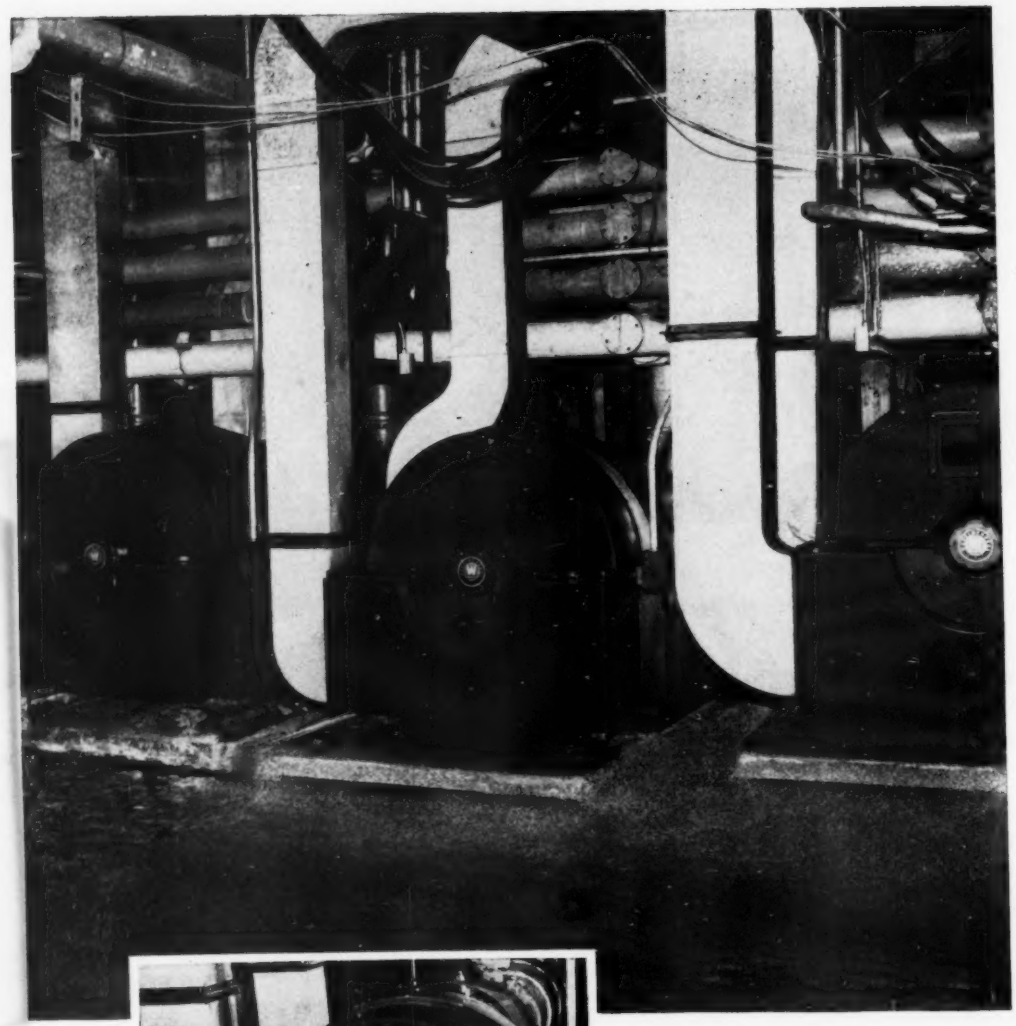
DETROIT SINCE 1896 STOKERS

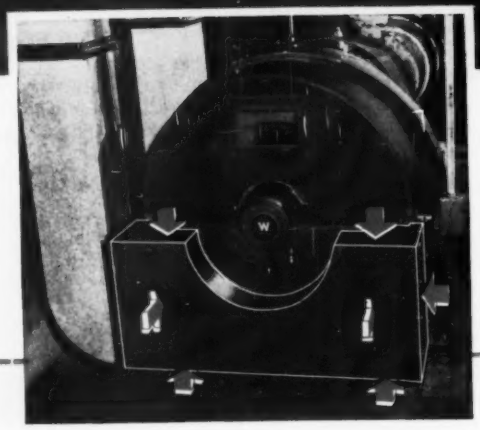
Other Types and Sizes of Detroit Stokers for Every Industrial or Power Need

DETROIT STOKER COMPANY

General Motors Building—Detroit 2, Michigan

District Offices in Principal Cities • Works at Monroe, Michigan





The above is a typical forced-ventilated installation. These same ducts could have been brought into these motors from any angle as shown by the arrows on the inset at the left.

WHERE FORCED VENTILATION IS REQUIRED . . .

Westinghouse Air Inlet Brackets Offer Complete Flexibility of Installation

From the top, bottom, front or either side . . . ventilating ducts or pipes may be brought in from practically any angle to this forced-ventilated, large induction motor. It's the ventilation system and design of the air inlet brackets that make this possible.

Ventilating air is supplied to the motor from both ends through the two air inlet brackets. These brackets can be supplied with duct or pipe connections located on any of the exposed surfaces. Thus, many installation problems are eliminated and the motor can be positioned without regard to the space available for duct work.

The ventilating air is discharged from both sides of the motor through louvered openings. If desired, these openings can also be housed so that the exhausted air can be routed away through similar ducts or pipes.

Other important Westinghouse features that you will want to consider in selecting your next large induction motor are:

Bearing construction and end enclosures make bearing inspection, cleaning, servicing and replacement as easy as on a standard open motor.

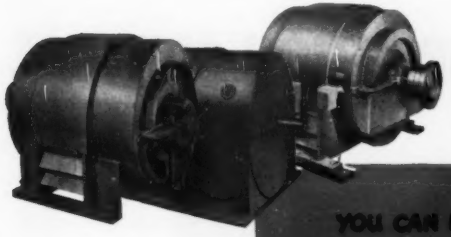
Welded steel construction to form a sturdy frame.

Insulation of great dielectric strength and high heat resistance for long life.

All-metal rotors are dynamically balanced for quiet, smooth operation.

Ask your Westinghouse representative about all the details of this improved large motor or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-10356



Also available are these three types of large induction motors. Open dripproof motors for general service. Outdoor motors for service in the open weather. Splashproof motors for protection against falling liquids or solid particles.

YOU CAN BE SURE . . . IF IT'S Westinghouse

LARGE INDUCTION MOTORS

what *results*

do you want from your

COMBUSTION CONTROL SYSTEM ?

Of course you want the best results you can get. But, more particularly, you want *specific results to solve your combustion problems.*

Hays engineers "focus" on your problems. They have the experience in planning combustion control systems to give you specific results like:

- smoke abatement
- reduced boiler room labor costs
- decreased outage
- constant steam pressure
- lower fuel bills by means of switching fuels
- increased boiler capacity
- firing mixed fuels efficiently
- rapid response to steam demand

Such specific results are described in the published "Case Histories" listed at the right. Here's how you can get them—

HOW TO GET RESULTS

Send a brief statement of your combustion problem and the results you want to Orval W. Riggs, Manager, Application Engineering, The Hays Corporation, Michigan City (3), Indiana. In return, you will receive:

1. Our preliminary recommendations for a solution to *your* problem.
2. A 48-page booklet on the various Hays control systems and how they work.
3. The five "Case Histories" giving details of Hays control, "getting results" on five different problems at leading companies throughout the country.

HAYS COMBUSTION CONTROL

Low maintenance?

"we find that due to the (Hays) properly controlled combustion, our maintenance on both stokers and boilers has been considerably decreased."

American Tobacco Company
Bulletin—AT

Good CO_2?

"CO_2 readings show that on an average day our CO_2 varies between 13% and 14% despite load fluctuations."

Sunshine Biscuits, Inc.
Bulletin—SB

Increased efficiency?

"Operating efficiency has been as high as 82%—much of the credit going to the accuracy of (Hays) automatically controlled combustion."

Sherwin Williams, Chicago Plant
Bulletin—SW

Fuel savings?

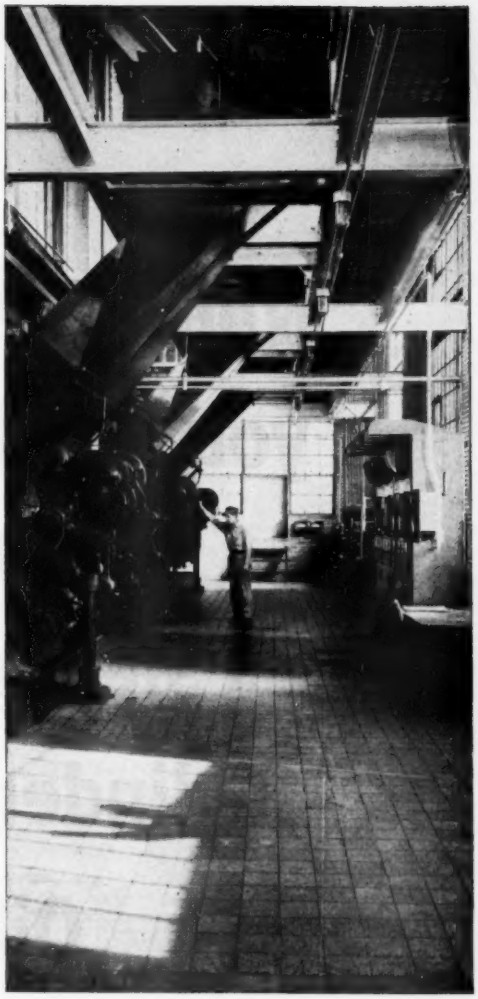
"we estimated that...we would be able to pay for the new equipment (Hays Combustion Control) out of fuel savings in three years. Since then, the records show that the amortization of the original investment has been accelerated."

Raybestos—Manhattan, Inc.
Bulletin—RM

Rapid response to wide load swings?

"we have made test runs using the Hays system, bringing the load rapidly up from 8,000 to 80,000 lbs per hour with excellent results. Fuel-air ratio was held at the desired value and CO_2 at 15%."

Bemis Brothers Bag Company
Bulletin—BB



Bulletin—AT

Bulletin—SB

Bulletin—SW

Bulletin—RM

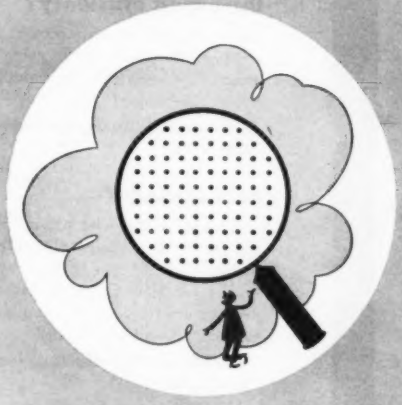
Bulletin—BB

THE **HAYS** CORPORATION *MICHIGAN CITY 3, INDIANA* • Automatic Combustion Control

Boiler Panels • Hays-Penn Flowmeters • Variflow Meters and Veritrol • Gas Analyzers • Draft Gages • Combustion Test Sets • CO_2 Recorders • Electronic Oxygen Recorders

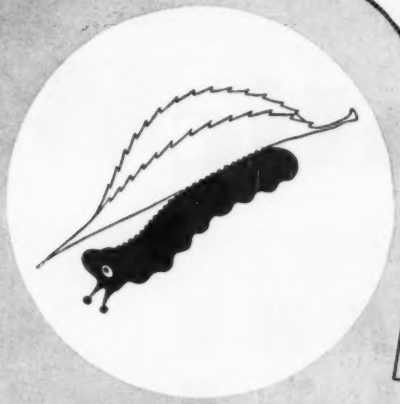
Whatever you need in a Steam Cylinder Oil...

Quick ATOMIZATION



DISTRIBUTION throughout the steam

HIGH TEMPERATURE resistance



ADHESION to cylinder walls and valves

RESISTANCE to washing off lubricated surfaces

Complete SEPARATION from condensate

Sinclair has it!

No matter what your operating conditions—
pressure, temperature, quality of steam; speed, loading;
condensing or non-condensing—
there is a Sinclair Steam Cylinder Oil made expressly
to give the utmost in lubrication satisfaction.

Through proper combinations of steam cylinder stocks and compounding ingredients, Sinclair lubrication technologists have developed a series of steam cylinder oils to fit the operating needs of any installation. There are oils that provide quick atomization . . . persistent adhesion to cylinder walls in the presence of moisture . . . rugged, wear-resisting lubricating films under super-heat . . . or complete separation from condensate where that is the dominating requirement.

A Sinclair lubrication engineer will help you select the proper oil for your particular service.

SINCLAIR
Steam Cylinder Oils

for every steam engine installation

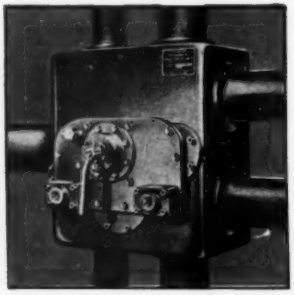
For lubrication counsel see your nearest Supplier of Sinclair Products or write Sinclair Refining Company, 630 Fifth Avenue, New York 20, N. Y.

Automatic Wa

now available with

COCHRANE ZEOLITE

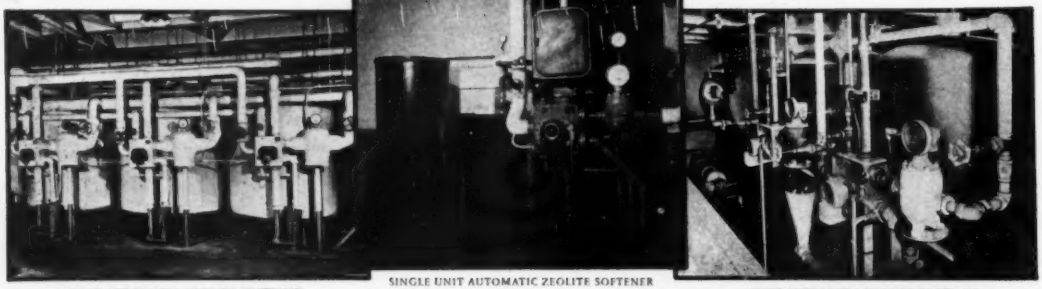
SOFTENER with the HYDROMATIC SINGLE CONTROL VALVE



AUTOMATIC water softening is now easily accomplished with the modern Cochrane Zeolite Softener equipped with the automatically controlled Hydromatic Valve. This remarkable valve combines, in a single pilot-actuated valve, the functions of six individual gate valves common to the customary "valve nest". For automatic control the valve is motorized and electrical controls, as shown on the opposite page, go into action. With a meter set to the degree of hardness of the water, regeneration is accomplished automatically and economically, with no further attention on the part of the operator.

WIDE RANGE OF ZEOLITES AVAILABLE

The Cochrane Automatic Zeolite Softener is adapted to any set of water conditions with zeolite material best suited to the raw water to be softened. Siliceous and Non-Siliceous Zeolites are available. The Siliceous include the low and high capacity greensands and the synthetic gels. The Non-Siliceous include the coal-base type and resins of the phenolic and styrene types. Cochrane service includes analysis and recommendation.

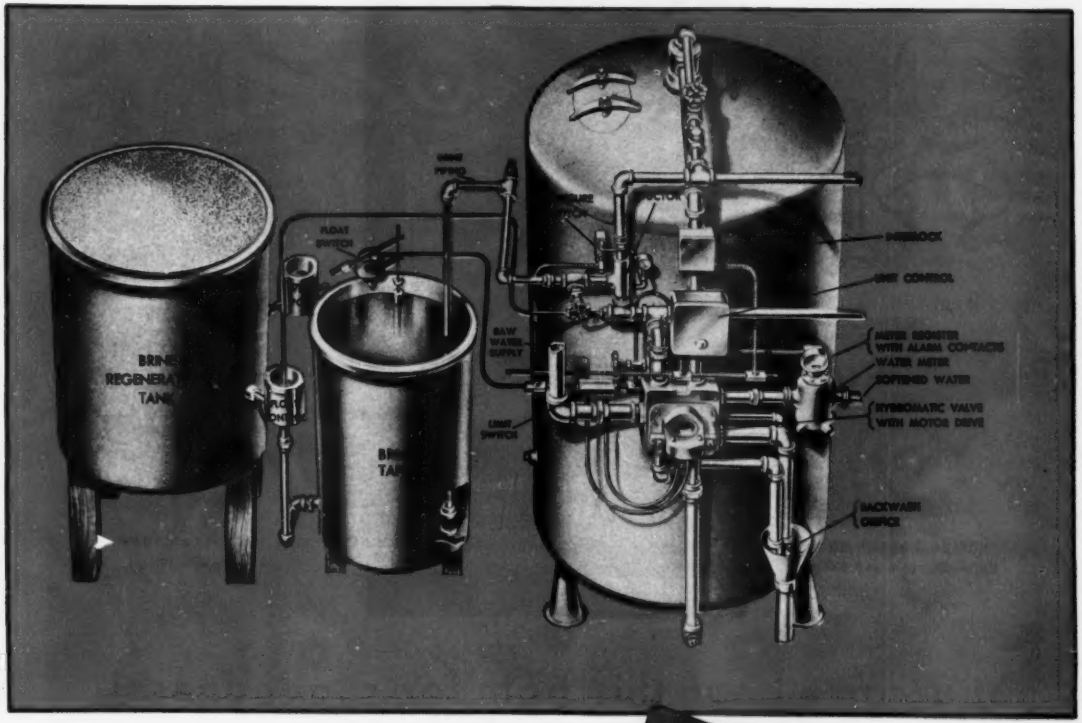


3-UNIT AUTOMATIC ZEOLITE SOFTENER

SINGLE UNIT AUTOMATIC ZEOLITE SOFTENER

2-UNIT AUTOMATIC ZEOLITE SOFTENER

ıter Softening



A new publication describing the zeolite process of water softening with detailed information and tables is just off the press. The coupon herewith will bring you a copy.

COCHRANE CORPORATION 88 YEARS OF SERVICE 1863 - 1951

COCHRANE CORPORATION

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In Canada: Canadian General Electric Co., Limited, Toronto

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Cochrane Corporation
3106 N. 17th St., Philadelphia 32, Pa.

Please send a copy of your Publication No. 4520 on Cochrane Zeolite Softeners.

Name.....

Firm.....

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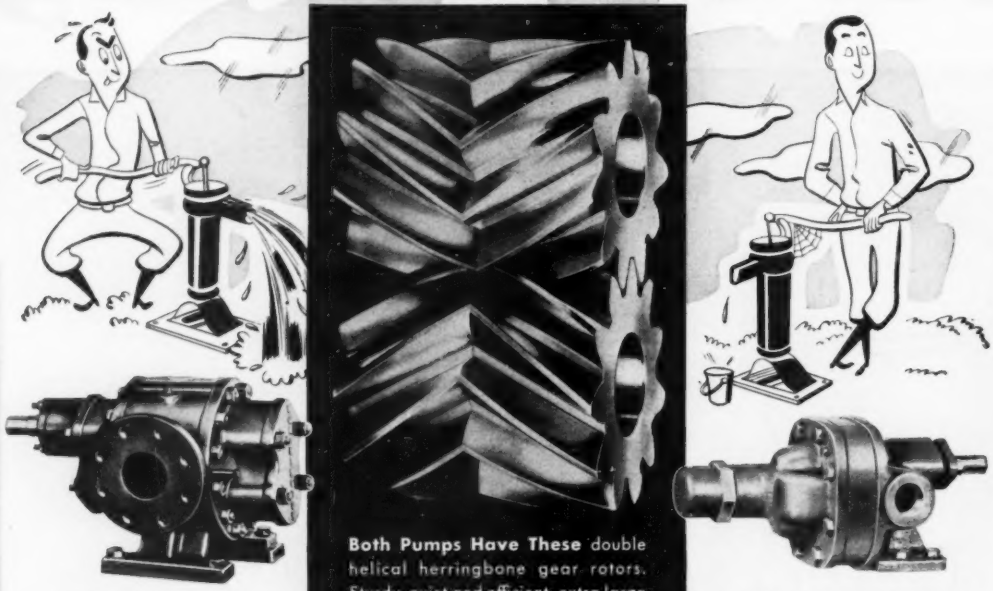
City.....State.....

Whether you're pumping

a lot . . . or . . . a little



Both Pumps Have These double helical herringbone gear rotors. Sturdy, quiet and efficient; extra large wearing surfaces; no axial thrust; no trapping of liquid.

TYPE GR ROTARY PUMP
Up to 5000 gpm and 500 psi

TYPE GA ROTARY PUMP
Up to 50 gpm and 100 psi

You can't beat this pair for ruggedness!

Or for trouble-free performance either — because, husky as they are in every detail of construction, they're the smoothest-pumping rotaries you ever hooked up! Both the heavy-duty Type GR and the light-duty Type GA have the special herringbone rotors that handle the widest range of liquids – hot or cold, thin or viscous — with steady, quiet efficiency. And each, in its own capacity range, is the soundest investment you can make for years of dependable, low-cost pumping service . . .

Get proof that *there's more worth in Worthington.* Write for further facts about these pumps to *Worthington Pump and Machinery Corporation, Reciprocating Pump Division, Harrison, New Jersey.*

MEMBER

WORTHINGTON

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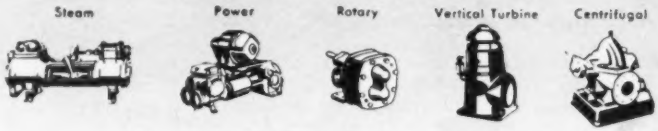
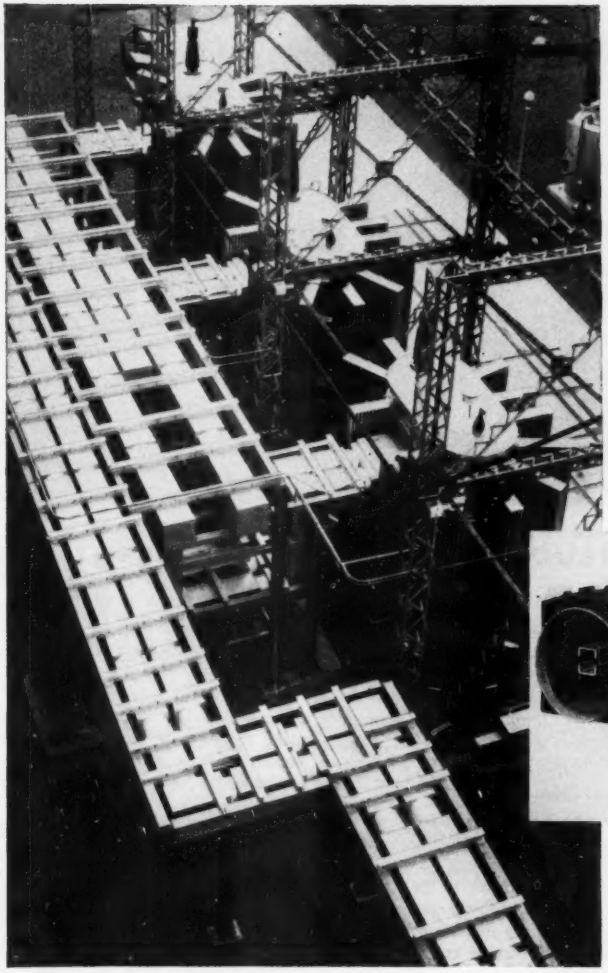
THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB



Now 14 out of 19

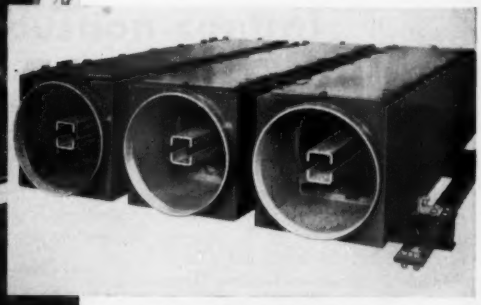
~~11 of the 16~~ largest turbine generators use G-E Isolated-phase Bus Runs



G-E isolated-phase bus runs provide maximum protection for vital interconnections between generators, transformers and main switchgear. They are dust-tight, weather-tight and factory-assembled to maintain adequate insulation values and mechanical strength. That's why they have been specified for the majority of the nation's largest turbine generators, either installed or planned.

Supplied in either individual phase sections or assembled as a complete three-phase package, G-E isolated-phase bus runs simplify installation problems and cut costs. Complete gasketing keeps the entire run weather-tight, reducing maintenance and the possibility of failures. You can open the hinged covers from either side for full flexibility, without removal of bolts. Ratings are 15 and 23 kv, 1200 to 7000 amperes.

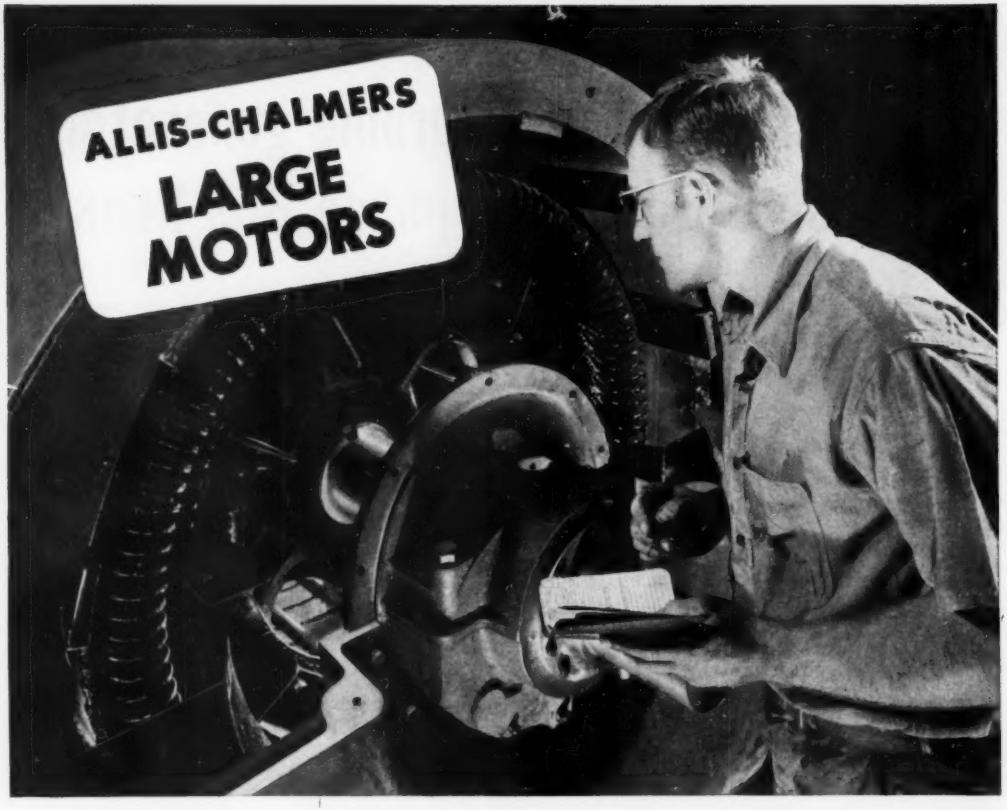
Your G-E Sales Representative has



complete information about isolated-phase bus runs. Ask him for a copy of GEA-5460, a 28-page publication. It will aid you in planning your bus runs, or write to Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

855-25

GENERAL ELECTRIC



HOW'S THIS FOR Accessibility?

ONE MAN can perform all routine maintenance jobs on this brand new line of Allis-Chalmers large motors. He can remove the upper halves of the end brackets and air baffles and reach right inside the motor with his vacuum cleaner or air hose. There is plenty of room to reach up back of the stator core through air discharge openings in the stator yoke.

Bearings Protected

The capsule-type sleeve bearings need not be opened up and exposed when the end bracket halves are removed. The bearings are protected from abrasive dust and dirt while the motor is being cleaned. This eliminates the work usually required to dismantle the bearing, clean and reassemble it during routine maintenance.

Easy Installation

Large stator air discharge openings with removable louvers allow ample room to use an electric or air drill for doweling and bolting the motor to the foundation. These large discharge openings plus adequate air intake openings in the end bells provide cooling air at low velocities.

Sleek Appearance

You'll be proud of the appearance of the new Allis-Chalmers motor in your plant, too. Clean, simple lines and smooth contours give outward confirmation of its inner strength.

These new design Allis-Chalmers drip-proof and splash-proof bracket bearing squirrel-cage induction motors are built in sizes from 60 hp at 300 rpm to 1500 hp at 1800 rpm. Ask your Allis-Chalmers representative to show you the details of this exceptional new motor or write Allis-Chalmers, Milwaukee 1, Wisconsin for Bulletin 05B7542. A-3251

ALLIS-CHALMERS

in flow metering

for EXTRA performance

in combustion control

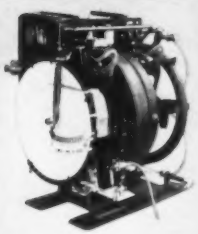
HAGAN CORPORATION

HAGAN BUILDING, PITTSBURGH 30, PA.

combustion control systems . . . ring balance flow and pressure instruments

HAGAN RING BALANCE FLOW METERS

RECORDING AND INTEGRATING METER FOR SINGLE FLOW —(Case removed) For differential pressure from 0.5" to 420" water column. Static pressures up to 3000 psig.



BOILER METER — For recording and integrating steam flow and recording air flow and exit gas temperature.

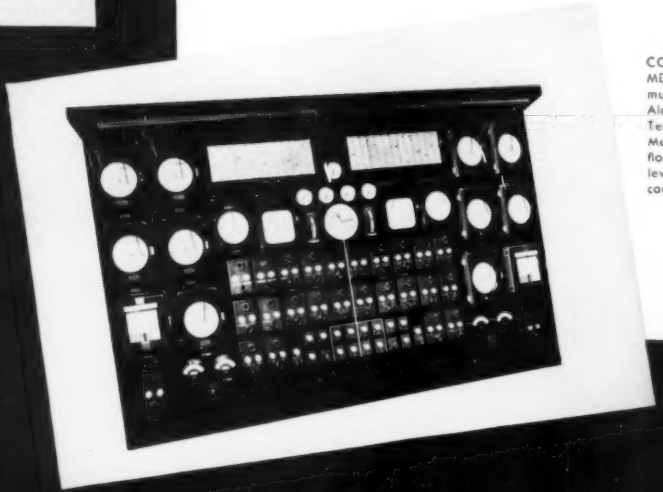
• sensitive • accurate • versatile

The extra performance of Hagan Ring Balance Meters is reflected in the characteristics of high sensitivity at low flows, accuracy in recording and integrating over the entire range, and *flexibility* that makes this the most versatile meter available today.

Measurements may be compensated for temperature or pressure, or both; compensated and uncompensated records may be obtained; and either may be totalized automatically.

Measuring units for two flows may be housed in a single case. These flows may be recorded individually, and a record of their sum or difference obtained. Either or both flows may be totalized automatically.

Measurements of fluid flow, liquid level, specific gravity of liquids or density of gases are a few of the possibilities, for there is a Hagan Ring Balance Meter to meet virtually every metering requirement.



CONTROL AND INSTRUMENT PANEL — Serving two multiple-fuel fired boilers at Alan Wood Steel Company. Ten Hagan Ring Balance Meters record gas flow, steam flow and boiler drum water level. Automatic combustion control is by Hagan.

HAGAN COMBUSTION CONTROLS

for every type of application

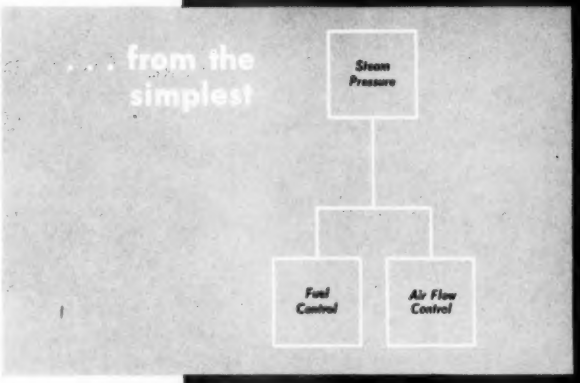
Hagan Control Systems have been supplied for boiler units ranging from 3,000 pounds per hour at 1.5 psi to 1,350,000 pounds per hour at 1800 psi.

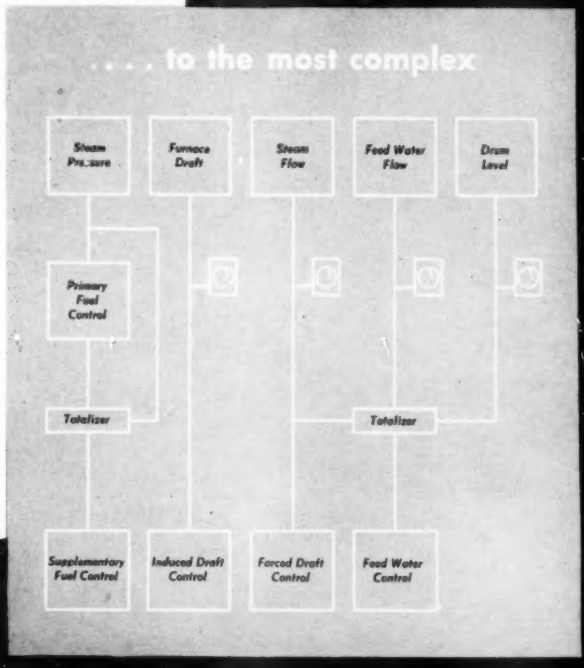
They are used on stoker fired boilers and on boilers fired with pulverized coal, natural gas, oil, waste refinery gases, blast furnace gas, coke oven gas—even sawdust.

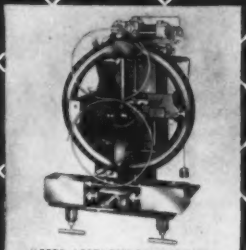
They are used with single fuel firing, or with varying combinations of multiple fuel firing.

Hagan Controls provide *precise* control of the exact fuel-air ratio required for most efficient combustion. The same exacting requirements are fulfilled in applications on industrial and metallurgical furnaces.

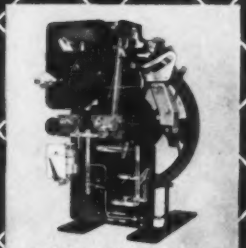
Whatever your combustion control problem may be, Hagan engineers will be glad to discuss it with you.



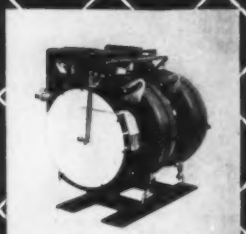




METER ASSEMBLY for static pressures between 3000 and 15000 psig and pressure differentials between 20" and 140" water column.



PRESSURE COMPENSATED METER ASSEMBLY—Standard models may include automatic correction for variations in temperature and pressure.



DUAL METER for recording and integrating gas flow and recording air flow.

few meters have

ANY of these features

only HAGAN

RING BALANCE

has ALL

Hagan Ring Balance Meters have these inherent advantages:

1 ***They do not employ stuffing boxes,*** hence there is no danger of leakage; sensitivity is greater; adjustment is less delicate; less maintenance is required.

2 ***Mercury level is not critical,*** hence the meter is easier to calibrate, and is not thrown out of calibration by loss of mercury as long as enough remains to serve as a seal.

3 ***Dead weight calibration can be used***—a quick, easy and accurate method employing weights supplied with the meter. Meter need not be disconnected.

4 ***They are adjustable over a wide range of differentials*** —as much as 7 to 1 in some models—by a simple range screw.

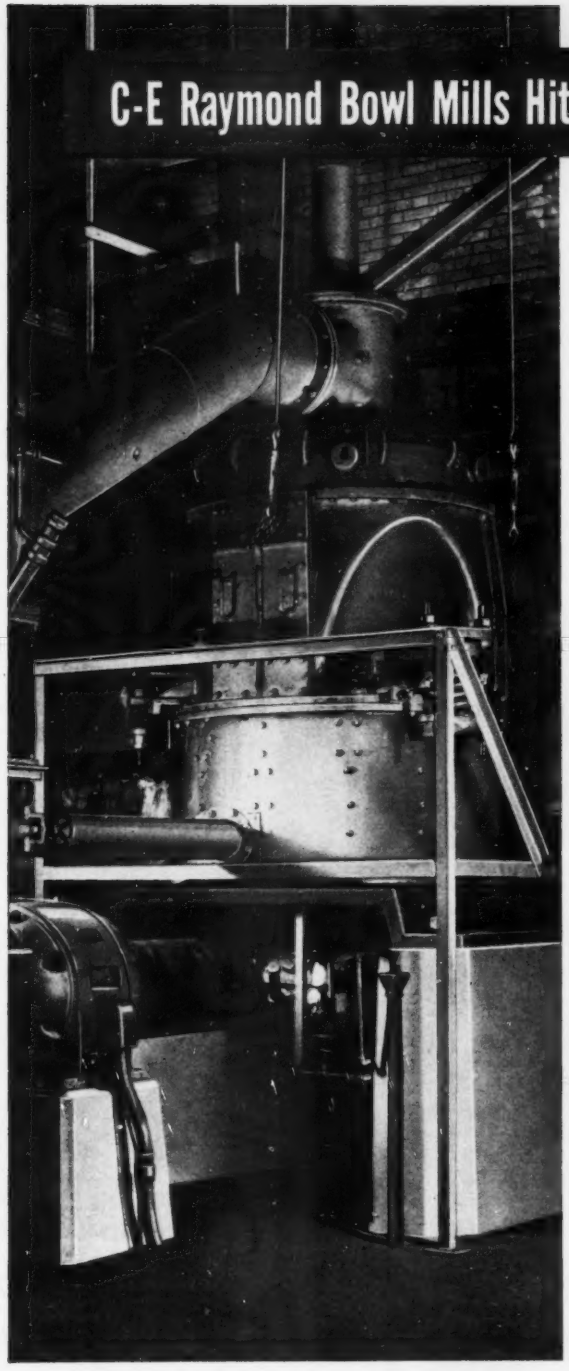
For more information on these and other features of Hagan Ring Balance Meters, send for Bulletin 2M51, or write us concerning any particular application in which you are interested.

HAGAN CORPORATION

HAGAN BUILDING, PITTSBURGH 30, PA.

ring balance flow and pressure instruments . . . combustion control systems

C-E Raymond Bowl Mills Hit New High in 1950



ordered for 5,000,000 kw of new electric generating capacity

Perhaps an even more impressive indication of Bowl Mill acceptance throughout the utility industry is the fact that . . .

. . . if all Bowl Mills purchased by American utility companies from January 1 to December 31, 1950, were to operate at 70% use capacity factor for a year, they would pulverize a total of

20 million tons of coal —

that's about ¼ of the amount of coal used by all utility companies in 1949.

No one factor could possibly account for this widespread acceptance. Rather it is the fact that the Bowl Mill's record of performance in hundreds of installations has been *outstanding* in *all* these important respects . . .

- **power consumption**
- **maintenance costs**
- **control characteristics**
- **ability to maintain capacity with wet coal**
- **ability to maintain fineness through life of grinding elements**
- **quiet vibrationless operation**

Check the facts of Bowl Mill performance on *all* these counts and you will understand why utility engineers continue to accord it such widespread preference. B-457

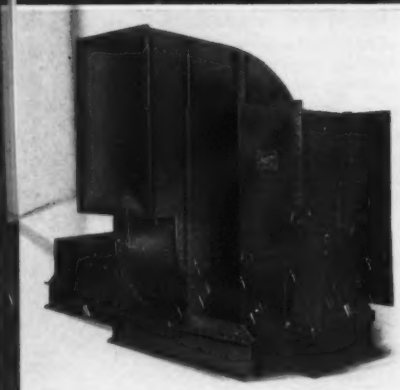
C-E

COMBUSTION ENGINEERING-SUPERHEATER, INC.

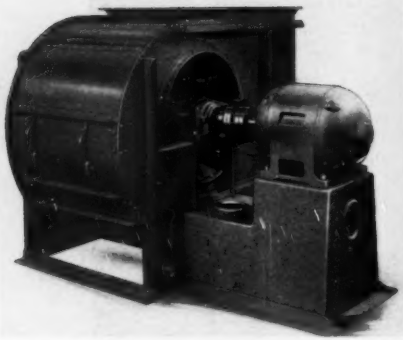
200 Madison Avenue • New York 16, N. Y.

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

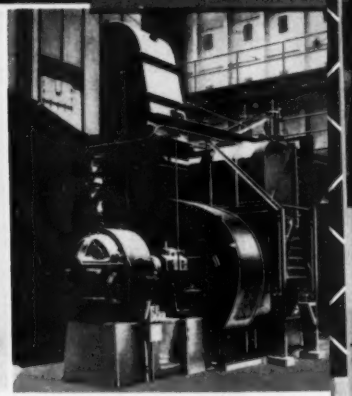
Left, large or small, every "Buffalo" rotor is dynamically balanced on a precision balancing machine before shipment. Even the largest rotors, like this double-width type, receive this treatment.



INDUCED DRAFT — "Buffalo" Single Width Induced Draft Fan with One Inlet Box and Water Cooled Bearings.



FORCED DRAFT — "Buffalo" Double Inlet Forced Draft Fan with Ball Bearings Mounted on Housing.



"Buffalo" Combination Draft Fans in Oil Refinery. Forced and Induced Draft Rotors Mounted on Common Shaft with Independent Pedestals and Bearings on Outboard Ends of Unit.

"Buffalo" First for

BALANCE...

MAKES A BETTER FAN

ANOTHER REASON FOR TOP PERFORMANCE

IN "Buffalo" DRAFT FANS

Every "Buffalo" Draft Fan rotor is balanced on a modern, dynamic balancing machine. This means much to the performance of the fan on the job, as every operating man knows. Smooth, vibration-free operation means elimination of bearing troubles, noise, and worry over shut-downs.

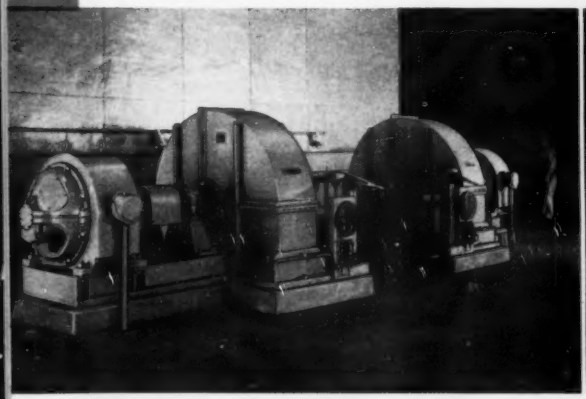
Of course, other things beside balance are important in draft fans — rugged construction, accessibility, high efficiency. "Buffalo" fans have these characteristics, too, as you see from Bulletin 3750, which gives complete construction details. Write for a copy.

BUFFALO FORGE COMPANY

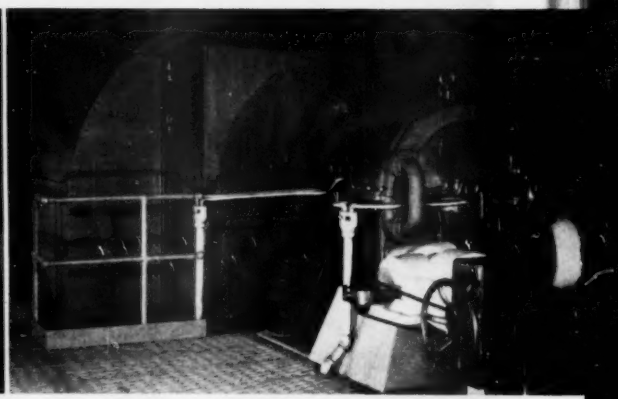
488 BROADWAY BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch Offices in all Principal Cities



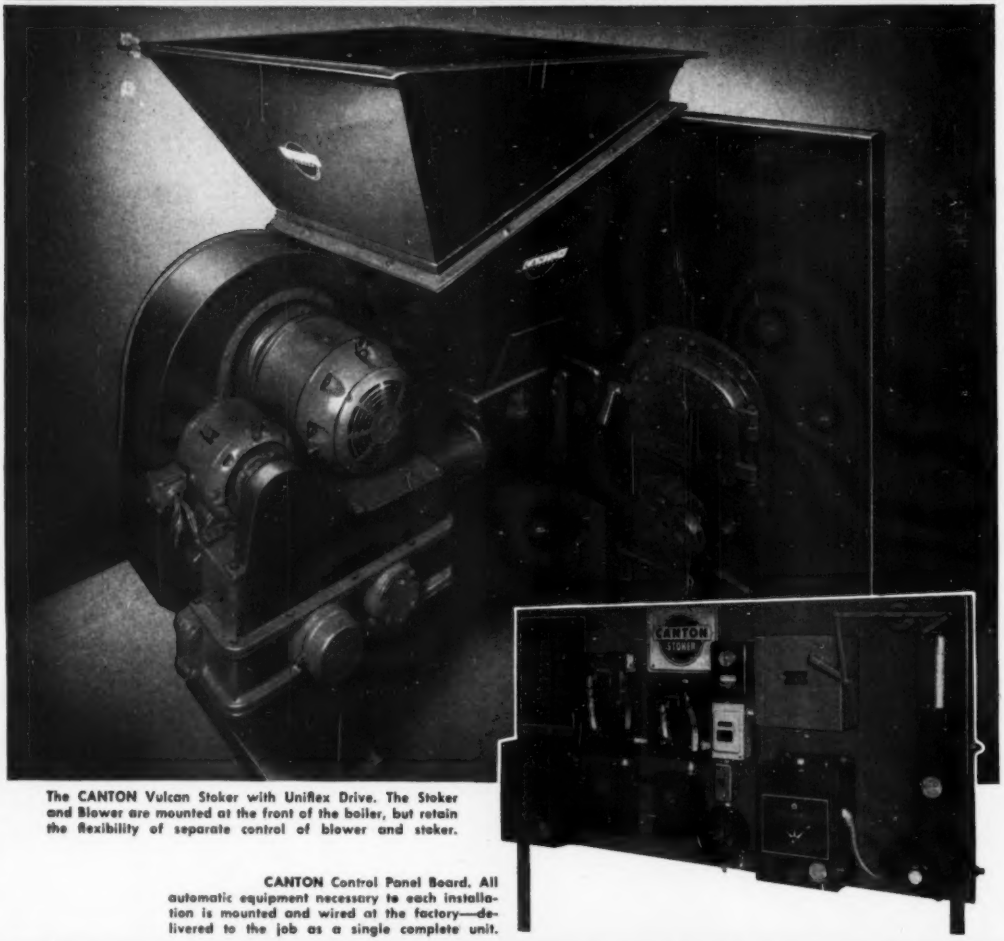
PRIMARY AIR — "Buffalo" Primary Air Fans blowing heated air mixed with pulverized coal into combustion chamber. A punishing, high pressure job for any fan, but all "Buffalo" Draft Fans are built to stand the service.



CINDER ELIMINATING — "Buffalo" Induced Draft Fan and Cleaning Equipment in One Compact Unit — requires less power than with separate fan and dust system, costs less and takes less space.

MECHANICAL DRAFT FANS

CANTON DEPENDABILITY



The CANTON Vulcan Stoker with Uniflex Drive. The Stoker and Blower are mounted at the front of the boiler, but retain the flexibility of separate control of blower and stoker.

CANTON Control Panel Board. All automatic equipment necessary to each installation is mounted and wired at the factory—delivered to the job as a single complete unit.

CANTON

SINCE 1910

COSTS YOU NOTHING!

CANTON STOKERS

There is no substitute for dependability—especially in a stoker, where your best value is found in the dependability of the equipment and of the company that produces it.

The four-way dependability "built into" Canton Stokers is the chief reason for its wide acceptance among consulting engineers, architects, operating engineers, and owners.

DEPENDABILITY OF ENGINEERING—Canton makes no "general-purpose" equipment, each installation being carefully designed and engineered to the specific requirements of the user.

DEPENDABILITY OF MANUFACTURE—From the selection of the finest materials and components through every step of manufacture and testing, Canton Stokers are fabricated and assembled with the greatest care and precision.

DEPENDABILITY OF OPERATION—Precision engineering and manufacture plus the use of top-grade components provide Canton Stokers with every property necessary to long, efficient operation and lower maintenance cost. This dependability has been repeatedly acknowledged by thousands of satisfied users during the past forty years.

DEPENDABILITY OF SERVICE—Canton maintains a complete service organization for prompt maintenance service anywhere, any time. This assures operators a minimum of downtime for their stoker equipment.

Add to these advantages the fuel savings accomplished and you have another reason why thousands of users are "sold" today on Canton Ram and Worm Feed Stokers for all types of power generating and heating plants.

CANTON STOKER CORPORATION
Andrew Place, S. W., Canton, Ohio
CANADIAN REPRESENTATIVE: Volcano Ltd., 743 Mountain Street, Montreal 3, Quebec
EXPORT DIVISION: W. B. Harkins, 751 Drexel Building, Philadelphia 6, Pa.

For detailed information on Canton Stokers, call or write the Canton Stoker representative nearest you or Canton Stoker Corporation, Canton 1, Ohio. *Bulletins on Request.*

Multiple CANTON LoSet Stoker installation with Overhead Coal Feed at J. Weller Company's Cannery, Oak Harbor, Ohio.

Three CANTON LoSet Stokers used by the General Hosiery Co., Ft. Wayne, Indiana.

Multiple CANTON Vulcan Ram Feed Stoker installation at Utah State Capitol, Salt Lake City.

CANTON RAM FEED STOKER DRIVE MECHANISMS ARE GUARANTEED FOR FIVE YEARS

STOKER

CANTON STOKER CORP. CANTON 1, OHIO

Sweet's File for Power Plants

looking

1 power generating equipment

steam generating	a
fuel burning	b
prime movers	c
heat transfer equipment	d

2 mechanical equipment

material handling	a
power transmission	b
pumps and compressors	c
pipe and fittings	d
valves and traps	e
instruments and controls	f
miscellaneous equipment and supplies	h

3 electrical equipment

motors and generators	a
controls	b

4 materials

glass	c
thermal insulation	d
refractories	e
roofing and siding	g
waterproofing and dampproofing	h
flooring and wall covering	i
paints and finishes	J

5 structural equipment

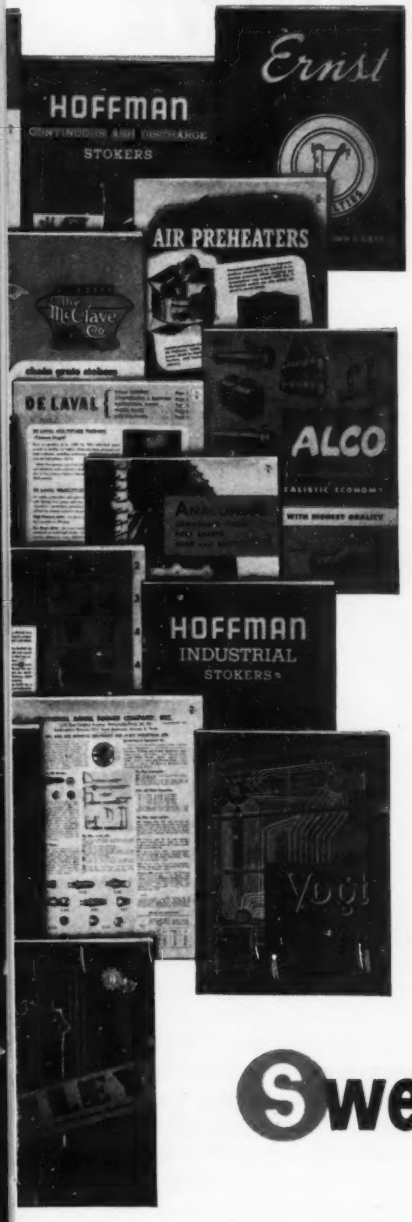
structural systems	a
doors and hardware	b
skylights and ventilators	c
partitions, fences and guards	d
chimneys	f

6 plant utilities

water conditioning and sewage disposal	a
air conditioning and refrigeration	b
lighting	c

7 special services

for power equipment?



reach for Sweet's

All these manufacturers' catalogs—containing comprehensive information on steam generating, fuel burning and heat transfer equipment, and prime movers—are instantly available in Section No. 1 of your Sweet's File for Power Plants.

The other sections of this Sweet's File contain additional catalogs covering a wide range of materials and equipment . . . useful and up-to-date information on product forms, characteristics, performance and use.

This grouping of manufacturers' catalogs, in sections according to products or use of products, is made for your convenience, so that you can more readily compare one product with another. Indexes of manufacturers, products and trade names lead you quickly and easily to the catalogs you are looking for.

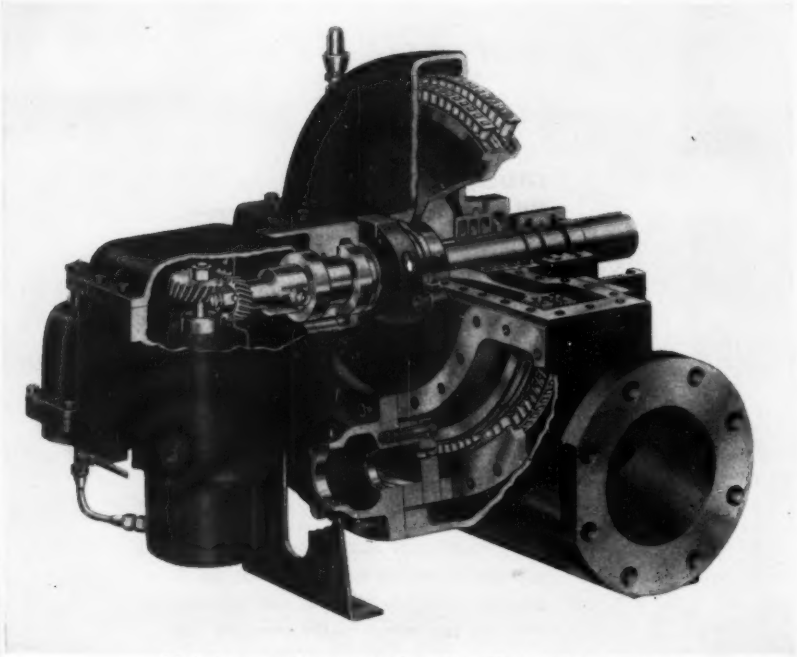
Sweet's is working constantly to get more manufacturers to send you their catalogs in this easy-to-use form. If you fail to find what you want, please tell us.

Sweet's catalog service

DIVISION OF F. W. DODGE CORPORATION

119 WEST 40th STREET NEW YORK 18, N. Y.

Now More Than Ever . . .
YOUR BEST TURBINE



DP single-stage turbines are rated from 10 to 1200 hp, 1000 to 5000 rpm

Type DP

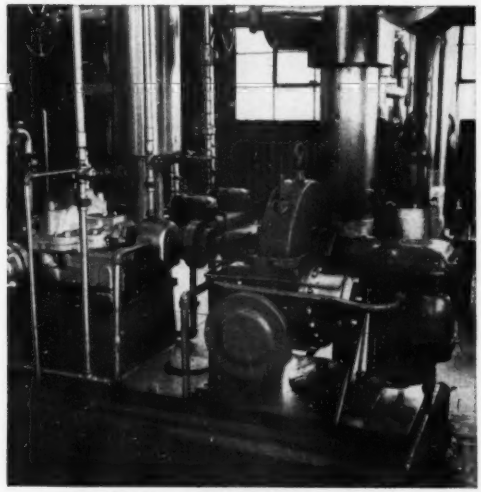
Since the introduction of the DP turbine, more than two years ago, General Electric has been telling mechanical-drive turbine users that their best turbine buy was a *standard* design, wherever it could be properly applied. Nowadays, with the emphasis on increased output, the advantages which turbine standardization offers are even more important.

Standardization means that turbines of different rating and size have mostly identical construction features. This speeds delivery, cuts manufacturing costs, makes possible a better design and a better turbine. If you're not familiar with the General Electric DP, we suggest that you contact your nearest G-E sales office or send for a copy of bulletin GEA-4955, "A New Standard in Mechanical Drive Turbines." Write to *Apparatus Dept., General Electric Company, Schenectady, N. Y.*

GREATER RELIABILITY

From its totally enclosed governor to its durable babbitt-faced bearings, General Electric's DP turbine is built to provide greater productivity through greater reliability. Standardization has made possible "extras" such as pressure lubrication, Monel-sprayed shaft, self-positioning packings, a totally enclosed hydraulic governor. You can count on your DP for safe, dependable service in hazardous atmospheres and on tough, continuous-process assignments.

DRIVE IS A STANDARD



This DP drives a centrifugal pump in a refinery

WIDE APPLICATION FLEXIBILITY

In plants which require shifting of equipment from job to job, a standard DP frequently eliminates the need for extra drives. Because most parts are identical for all ratings, speed range and shaft horsepower can be easily and economically changed to fit new conditions. Though the DP's 30% adjustable speed range is usually adequate, a new range can be set anywhere from 800 to 5000 rpm simply by substituting a new emergency governor and governor gears. A change in horsepower rating usually requires a new nozzle plate and a few valve parts. These parts are all available on immediate delivery and save the expense of a new turbine which would be required with a less flexible, non-standard unit.

Standard spare parts kits are available with all DP turbines

EASIER, QUICKER MAINTENANCE

Because most parts of standard DP's are interchangeable on all models, spares can be easily stocked, and maintenance work handled quicker. You can have delivered with the turbine a 91-item spare parts kit, sufficient to service several machines. Socket-head cap screws are used throughout for quick disassembly. Standard shaft height, keyways, and coupling fits simplify installation. You can move DP's from job to job without change in the base structure.

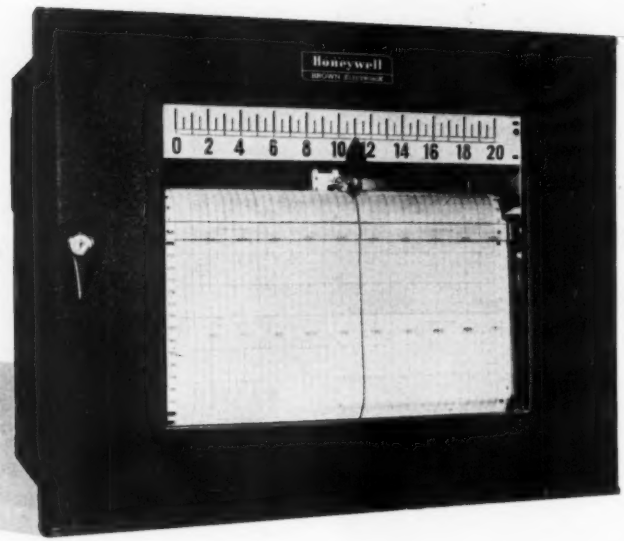
GENERAL ELECTRIC

252-49

MINNEAPOLIS Honeywell BROWN INSTRUMENTS

. . . SYMBOL OF SIMPLIFIED OPERATION AND MAINTENANCE

IT WILL PAY YOU TO TAKE A GOOD LOOK at the



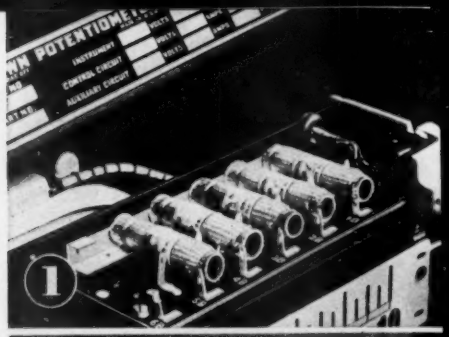
LIKE all other products that bear the Honeywell nameplate, the *ElectroniK* Potentiometer has established a reputation for sound design and construction, with flexibility . . . all of practical importance to superintendents, engineers and instrument men.

Thorough research, common-sense design engineering and practical field testing have contributed to the many features which add up to the simplified operation and maintenance of the *ElectroniK* Potentiometer.

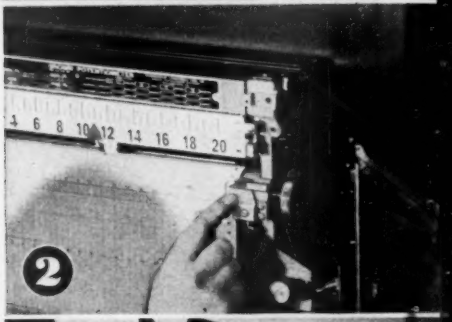
The chassis of all *ElectroniK* Potentiometers . . . Circular Scale and Circular Chart, as well as Strip Chart . . . swings out 180° to permit easy access to all components. Maintenance is simplified and time consuming dismantling for change of range or control unit is eliminated. Dowel fitted parts prevent misalignment of the swinging chassis.

ElectroniK

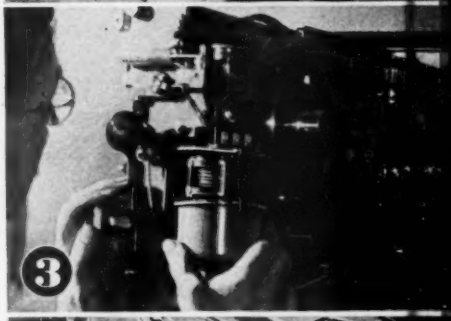
POTENTIOMETER



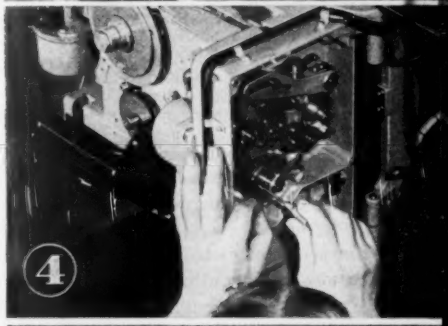
1 The circuit resistors are practically at your fingertips, making for easy range changes without removal of other components. Ranges may be varied for many sensing or detecting elements wherein an emf is created.



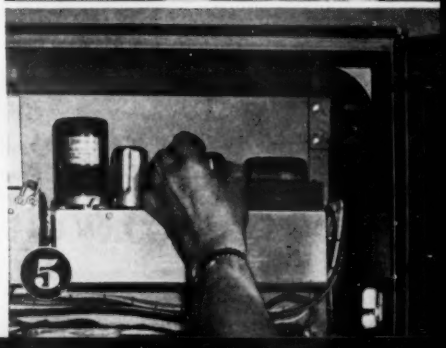
2 Easy to see and read is this pointer which indicates condition of the battery used to supply current to automatic standardizer.



3 The totally enclosed slidewire is easily accessible. Its many convolutions establish basis for the high sensitivity of the *ElectroniK* Potentiometer.



4 All mechanical parts are readily accessible for necessary lubrication and inspection of the instrument.



5 The amplifier of the *ElectroniK* Unit is readily accessible. This, plus unitary construction, adds much to the simplified operation and maintenance of this instrument.

Take a *good look* at the five features presented here . . . and then call in your local Honeywell engineer for a discussion of their utilization in your plant. Catalog sent on request. MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4490 Wayne Ave., Philadelphia 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

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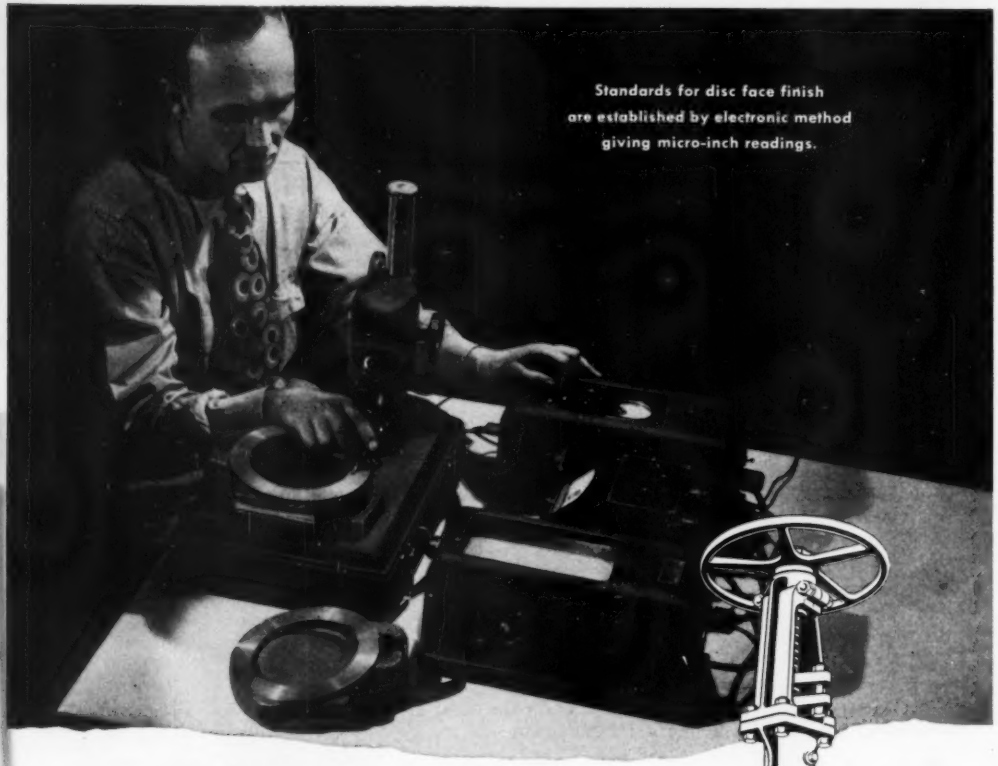
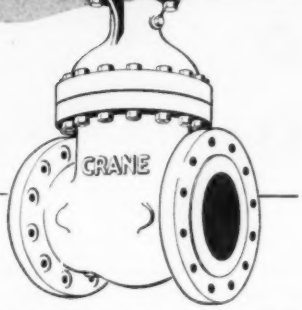
More **CRANE VALVES** are used than any other make



How CRANE controls quality to the Micro-Inch to cut your valve costs

Surface finish of a valve's working parts has a lot to do with its wear resistance and operating efficiency. A correct finish means a tighter-seating valve, easier operation, greater ease of maintenance. In Crane Quality valves, the surface finish of machined parts is measured and controlled to rigid limits. The standards for quality control of surface finish are determined by the most scientific methods as shown above. Yes, nothing is overlooked to make Crane Valves the lowest-cost valves in the long run. *That's Crane Quality!*



Precise quality control of materials, design, and manufacturing—to the highest degree in the industry—makes Crane valves the lowest cost valves in the long run. On steam service, oil and oil vapor lines, for example, you'll find Crane Steel Gate Valves a sure remedy for high maintenance costs. Talk it over with your Crane Representative.

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WHEN ECONOMIC FACTORS fail to justify more comprehensive water treatment, protect your steam-condensate system from CO_2 corrosion with Allis-Chalmers No. 160 Series Corrosion Inhibitor. This material, designed to vaporize and condense with the steam, neutralizes condensate *where* and *when* it forms — whether in the low pressure turbine stages or in the steam and condensate piping.

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No. 160 Series Corrosion Inhibitor may be the answer to your problem if deterioration of your steam-condensate system or steam using equipment is high. Corrosion testing equipment is available through Allis-Chalmers for an accurate check on deterioration "before and after" treatment. Find out for yourself how much protection — or a lack of it — will cost you.

For a factual discussion of the new Allis-Chalmers No. 160 Series Corrosion Inhibitor, write for bulletin number 25X7582 or contact your nearby Allis-Chalmers Office. Representatives there will arrange to have your problem brought before an Allis-Chalmers water conditioning specialist.

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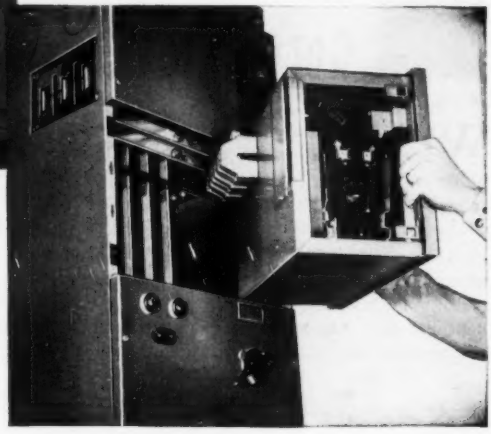

New Features Save Floor Space, Speed Up Wiring, Facilitate Operation

LESS FLOOR SPACE NEEDED

Compact trough design allows more troughs to be used in a given area of floor space.

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Generous (4 x 8 in.) wiring gutter makes wiring easier —can be accomplished with units in the trough—and allows use of over-size cable on long runs, keeping voltage drop low.

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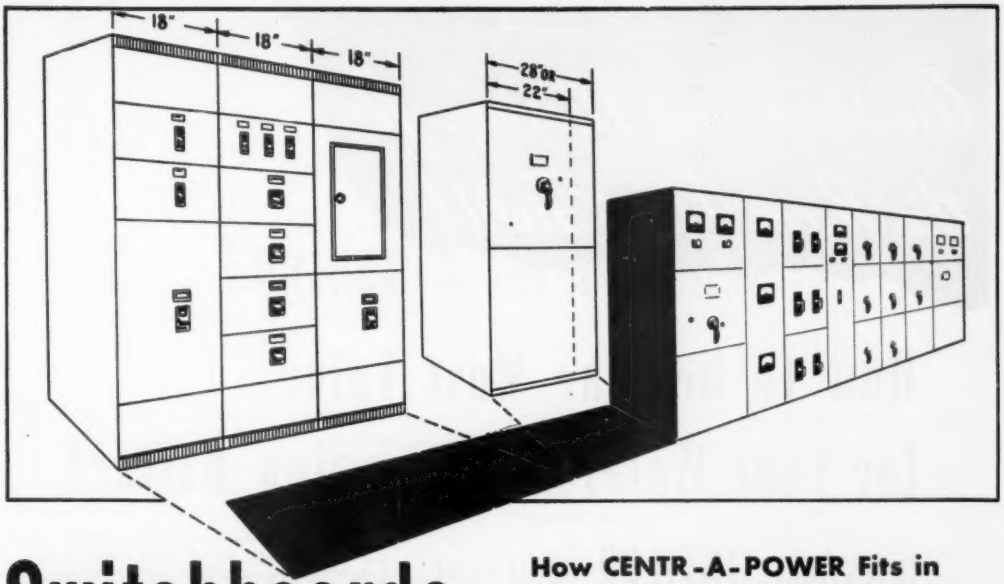
CENTR-A-POWER Switchboards are completely accessible from the front, permitting aisle, back-to-back, "L" and "U" installations, further saving floor space.

TRUMBULL'S TRAINLOAD OF NEW PRODUCTS



Switchboards

. . . at money-saving prices

To save you money on installation time and maintenance costs, Trumbull has designed a new type of switchboard for complete low voltage (600 V and under) switching requirements. Because of pre-engineering and standardization, you can now have the highest quality construction at the lowest possible cost. Here are some of the features:

Pre-fabricated, rigid steel troughs can be placed in any arrangement to provide a completely dead-front, totally-enclosed switchboard. Wiring gutter design is such that load wiring is isolated from incoming load bus. Compact switch or breaker units, called CENTR-A-PLUGS, are easily mounted or removed. A quick-clip attachment saves time in installation, inspection and maintenance. Self-aligning latches replace bolts and nuts. Positive connection to bus bars is assured by use of spring-loaded, reinforced stabs. Each CENTR-A-POWER unit self-contained and electrically isolated from adjacent units.

How CENTR-A-POWER Fits in with Your Present Rigid Type Switchboard Equipment

CENTR-A-POWER is made from three standard troughs, all 90 in. high. At left is unit type CENTR-A-POWER with 18 in. trough; it handles fusible switches through 200 amp. and circuit breakers through 600 amp. Two standard section troughs are indicated in the center. Type A is 22 in. wide, handles 400 and 600 amp. fusible switches. Type B is 28 in. wide, handles fusible switches through 1200 amp. and circuit breakers through 1600 amp.

Unit-Type Troughs (18 in.) are furnished assembled or unassembled. Large standard sections are furnished assembled only.

ASK ABOUT TRUMBULL CENTR-A-POWER CONTROL CENTERS

which are of similar construction and line up mechanically and electrically with CENTR-A-POWER Switchboards.

New Free Bulletin—Address The Trumbull Electric Manufacturing Company, Plainville, Conn. Ask for Bulletin TEB-3.

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Year after year, Infilco Equipment stands the test of time. The extra value of sturdy construction and realistic ratings pays off in more trouble-free, long service life. Investigate, today, the value you get from Infilco Water Conditioning Equipment. Call in the nearest Infilco Field Engineer. He's only a phone call away. There's no obligation, of course—only the obligation to yourself to investigate why Infilco Equipment is a good buy.

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New Bulletin No. 1855. It gives interesting facts and pictures on boiler feedwater treatment and the Hot Process Accelator.

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Power

PHILIP SWAIN, EDITOR • FEBRUARY 1951 • ESTABLISHED 1882

Engineers for Defense

AMERICA FACES A CRITICAL SHORTAGE of engineering graduates. The 45,000 young men who picked up their technical diplomas in 1950 were barely enough to fill industry's normal needs. Present enrollments in the various classes indicate that about 35,000 will be graduated in 1951, 25,000 in 1952, and only 19,000 in 1953.

While the supply of engineering grads dries up at this alarming rate, defense production will demand more engineers than ever. The last straw would be the induction of some of these scarce engineers and engineering students into the armed forces for the performance of nontechnical duties.

By now it should be plain to all that America can't maintain the peace or win a war (if it comes to that) by merely matching the enemy's armed hordes, man for man. He's got the numbers. To win, we've got to use our specialties—engineering know-how and national productivity. By applying our technical brains and machinery we must arm every American soldier, sailor and air man beyond anything the world has ever known—beyond anything the enemy's best effort can accomplish. There is no other way out.

That means mass-producing weapons, trucks, ships, planes and all the usual paraphernalia of war. It also means intensive development of such advanced weapons, machines and devices of all kinds that we shall always be far ahead of the other fellow. We can't do either without engineers, so common sense forces us to several conclusions:

1. We must take immediate steps to get more young men enrolled in engineering schools.

2. We must make sure that the draft does not drain off engineering students into nontechnical military jobs.

3. We must also make sure that practicing engineers are not pulled off essential defense projects to serve nontechnically in the armed services.

4. We must make sure that graduate engineers, in general, work where they can be of most help to the nation as a whole in this crisis.

5. And we must make sure that the necessary exemption of most engineers from ordinary military service for the very sound reasons just stated never becomes merely an alibi for men who lack the will and courage to face front-line dangers.

Meeting these requirements squarely, the Engineering Manpower Commission of the Engineers Joint Council, representing the five founder engineering societies and the American Society for Engineering Education, has proposed a National Engineering Personnel Board. This Board would administer a reserve created by registering every man up to the age of 70 who has a bachelor's degree in one of the critical fields of engineering, or who is enrolled in a program of training leading to a bachelor's or a higher degree in one of these fields, or who is employed in one of these fields.

The Board would review registrants, classify them and select those with critical skills for military, civil defense and industrial jobs.

The Commission urges that full-time qualified students of engineering be permitted to complete their education, and suggests running the schools right through the summer vacation period to speed graduation without cutting educational corners. It urges protecting essential engineering teachers from military draft. It proposes a campaign among high-school seniors to increase enrollment in engineering courses.

Although some parts of the Commission's plan are open to argument we can't see any two ways about the main points, which can be briefed this way:

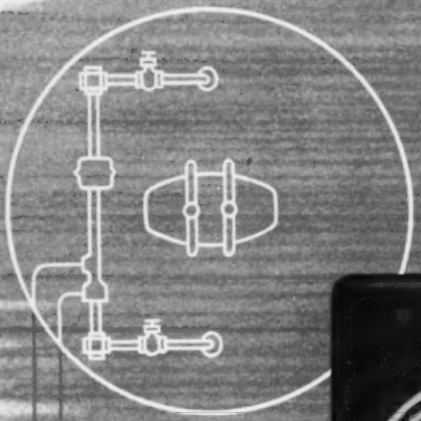
1. There aren't enough engineers coming along for essential production plus research and development.

2. We must get more boys enrolled in the engineering schools.

3. Using engineers and engineering students for nontechnical military jobs won't get us anywhere.

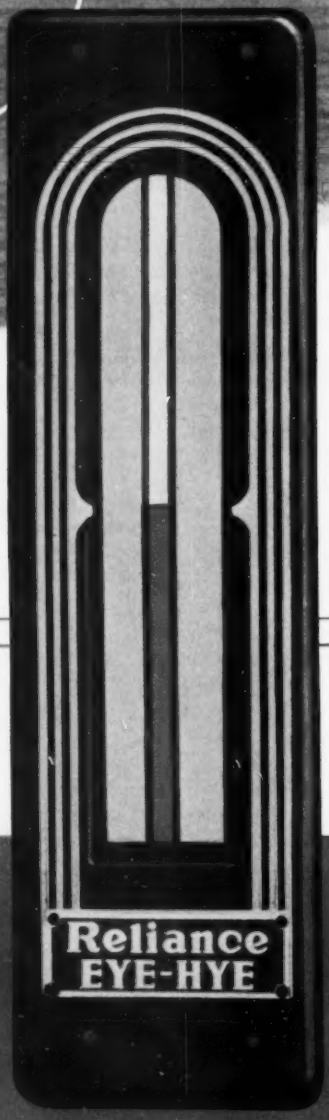
4. Some way must be found to put all engineers where they must do the most good.

EYE-HYE® helps



Reliance UNITEMP® — complete temperature equalizing unit—furnished with each EYE-HYE

Complete line of Water Columns, Water Gages and other trim for all working steam pressures



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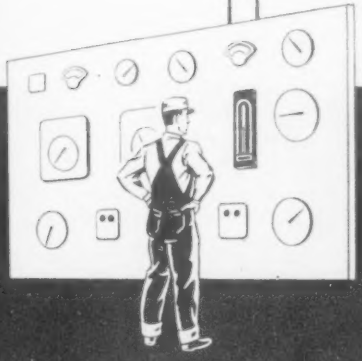

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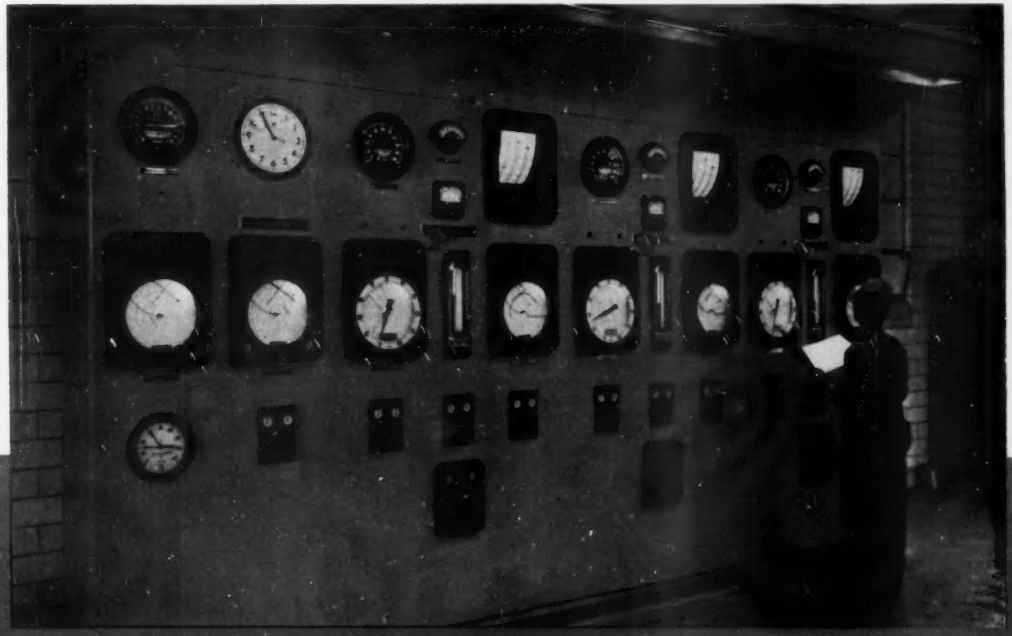

Three EYE-HYEs on panel board at The Jeffrey Mfg. Co., Columbus, Ohio

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When the old stack at the Great Lakes Box Company, Cleveland, Ohio, failed after a comparatively short period of service, company engineers looked around for a more durable stack material. They settled on Byers Wrought Iron. The new stack, welded throughout, 44-inches by 100-feet, was fabricated from ¼-inch wrought iron plate by the Acme Boiler and Welding Company.

Unlined metal stacks face severe corrosive conditions. Carbon dioxide is always present as a combustion product, and some sulfur compounds are generally encountered. When these are dissolved in condensed moisture, a dilute acid is formed which causes severe damage to vulnerable metals. Even when initial conditions are not severe, foresight suggests the use of durable material. For the aggressiveness of attack may be aggravated at any time, by the change of fuel, by the use of economizers or steam-jet draft inducers, or by intermittent operation. These factors can easily cause maintenance headaches unless proper safeguards are used.

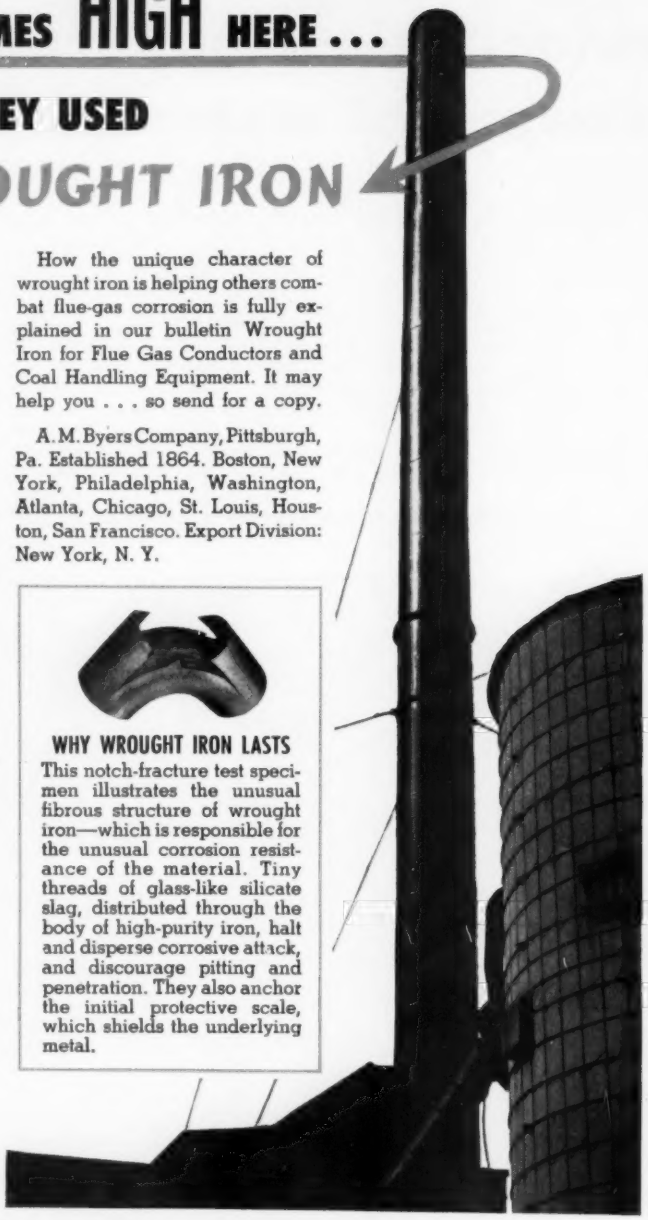
Byers Wrought Iron is a veteran in stack service and engineering records provide convincing evidence of its superior durability. Service ratios of two and three to one, as compared to ordinary stack materials, have been reported by many users.

How the unique character of wrought iron is helping others combat flue-gas corrosion is fully explained in our bulletin Wrought Iron for Flue Gas Conductors and Coal Handling Equipment. It may help you . . . so send for a copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, N. Y.

WHY WROUGHT IRON LASTS

This notch-fracture test specimen illustrates the unusual fibrous structure of wrought iron—which is responsible for the unusual corrosion resistance of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and disperse corrosive attack, and discourage pitting and penetration. They also anchor the initial protective scale, which shields the underlying metal.



BYERS

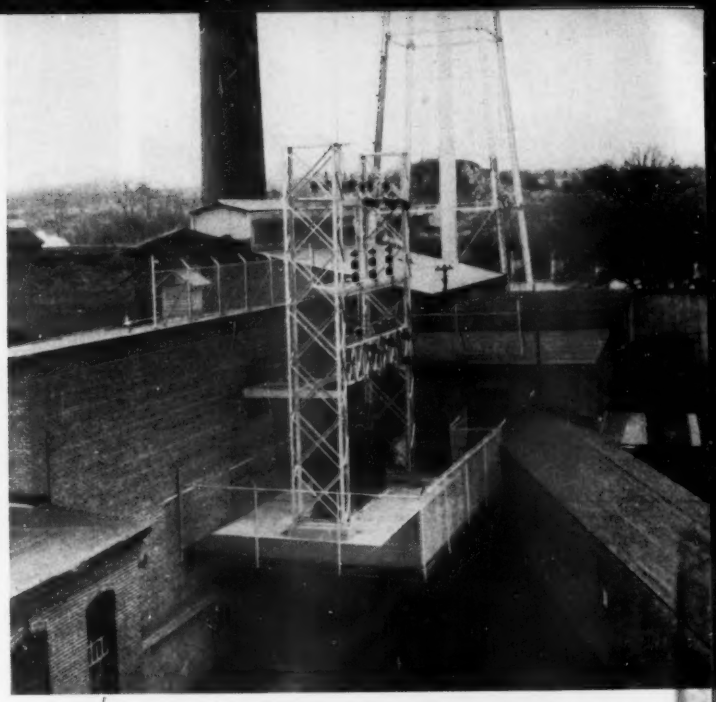
CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

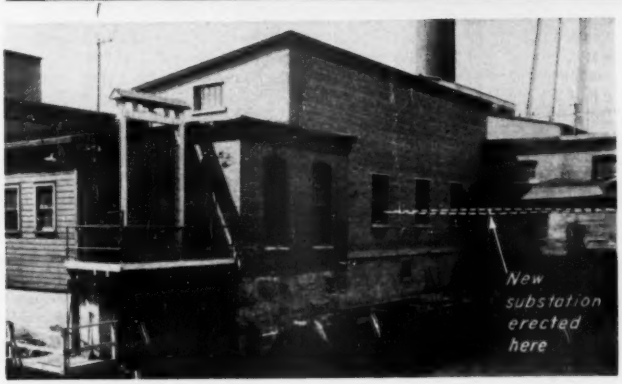
TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

Modern substation stands alongside 60-year plant that had always depended on water power only. New tie-in with the local utility assures continuous power when the water source falters



Hydro-electric power is still generated at 440 volts. But new transfer switches in the plant allow the operator to select either utility or plant bus for loading



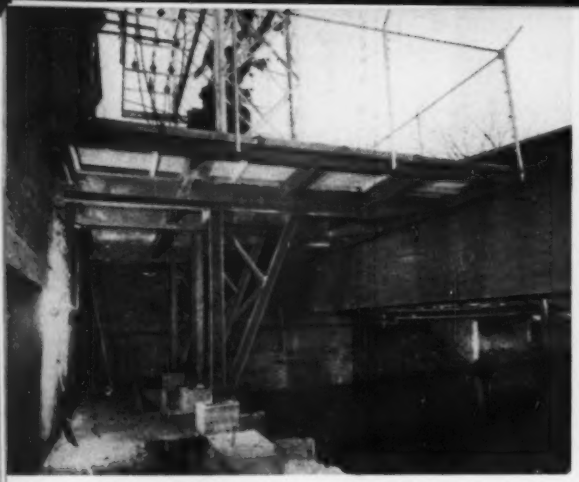
Utility Tie Props Industrial Hydro

By **EMILE GORHAM**, *Consulting Engineer, Union City, N.J.*

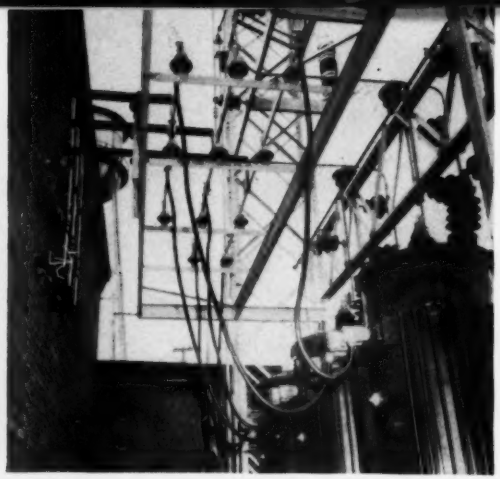
► YOUNGSTERS in Thomson, N. Y., a small town on the Hudson River 40 miles north of Albany, were mighty happy last winter when the mercury dipped almost out of sight—and stayed there three days. It was 30 degrees below zero. The school board closed the schools, but it wasn't too cold for the kids to flock to the river and skate on ice that was frozen five feet thick.

But the working folk looked on the ice with some misgivings, because generally when it froze that thick there wasn't enough water to power the water wheels at United Board and Carton Corp paperboard mill. The mill had depended solely on water power to supply mechanical and electrical power to the plant. So the deep-freeze just about meant a temporary shutdown of the small town's supporting industry.

Looking Back. A V-shaped dam stretches across the river about a half mile north of the plant. Starting at this point the water is channeled through a short canal into the spillways under the mill. The plant's five hydro-generators and mechanical water wheel and two steam-engine generators will produce about 2250-hp with ideal



SUBSTATION PLATFORM is cantilevered in front of present generating room. Means shorter run for transformer secondaries



THREE 500-KVA TRANSFORMERS, 33,000/480 v, Y-delta. If one fails, remaining two can be connected open-delta

water conditions. And that means about a 16-ft head. This figure of 2250-hp is the total demand load needed to run the beaters, pulpers, Jordans, etc.

"Free" water power proved a mighty expensive operating cost at this mill — expensive because production was stopped when there was little or no water power. And then there was the maintenance cost, usually at time-and-a-half for clearing ice and other debris from the trash racks.

To eliminate these uncertain and costly conditions United's management laid aside $70,000 to cover cost of installing additional equipment so the plant could be tied in with the local utility. This outlay of $70,000, they figured, should be returned, and then some, in the form of reduced operating costs and increased production. Then again production scheduling of high-grade paper calling for large blocks of power will no longer be at the river's mercy.

When the mill was built in the nineties it was set up for production of ground wood pulp only. This seemed a natural at the time since timber for pulp and water for power were abundant at the turn of the century. But they failed to stand up over the years; water shortages followed in the wake of ruthless cutting of timber.

Naturally, during the years there were many changes. Perhaps the most important was going from ground wood to paperboard. This change meant waste paper was now the raw material. And perhaps of less long-term significance were the changes in power facilities. In a nutshell the power changes meant adding hydroelectric generating equipment to replace water-driven and steam-driven equipment. This investment proved a serious mistake for it meant greater dependence on the river.

Engineering Survey. Mechanical and electric power had been furnished by all of the following three methods:

1. Steam prime movers driving constant- and variable-speed line shafts and electric generators.

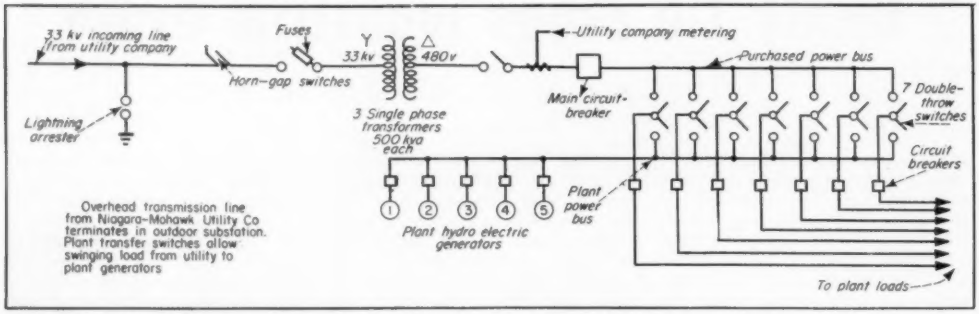
2. Water-wheel turbines driving constant-speed line shaft.

3. Water-wheel turbines driving electric generators.

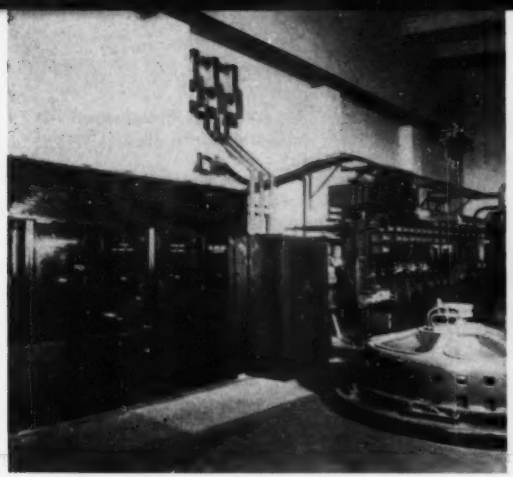
No change in steam prime movers was considered since it was not desirable to upset the mill's steam balance. Steam-driven generators were considered as source for a steady block of power.

But item 2 — water-wheel turbines — was a constant source of trouble and unreliable power. In the modernization plan this line shaft was put to rest and its load driven by individual motors.

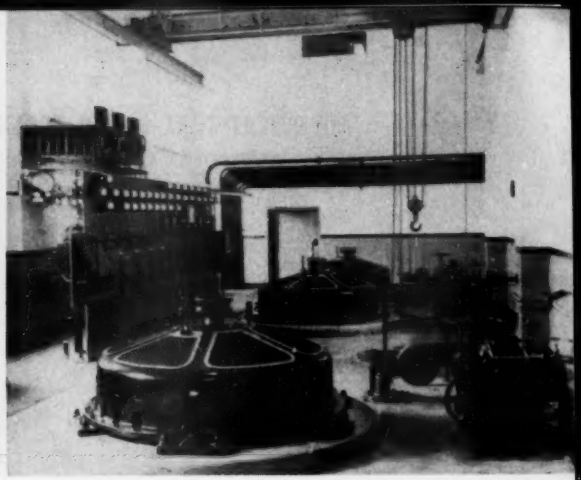
Hydro-Generators. Of course the main trouble spot in the mill was the water-driven electric generators. Electric power from this water source was generated and distributed through the mill at 440-v, 3-phase, 60-cycle. Even with a demand factor of 70% there


33 kv incoming line from utility company
Fuses
Y 33 kv
△ 480 v
Utility company metering
Purchased power bus
Horn-gap switches
Main circuit-breaker
7 Double-throw switches
Lightning arrester
3 Single phase transformers 500 kva each
Circuit breakers
Plant power bus
1 2 3 4 5
Plant hydro electric generators
Overhead transmission line from Niagara-Mohawk Utility Co terminates in outdoor substation. Plant transfer switches allow swinging load from utility to plant generators
To plant loads

SELECTIVE SWITCHBOARD gives operator wide latitude in choice of power. For instance, he can direct utility power to load centers of known high power factor, thus reducing kvar charges. Low pf loads are taken by plant generators for the time being



OVERHEAD BUS (*center*) leads from outdoor substation. Transfer switches (*left*) allow loading either plant or utility bus



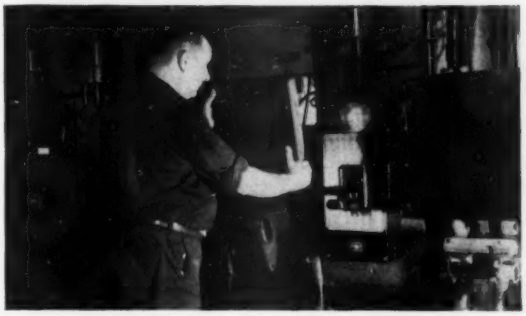
HYDRO-GENERATORS are powered from three separate spillways. Governors to right automatically change pitch of blades

was an apparent deficiency of about 400 kw even under the most favorable operating conditions. Actually though, low head water, high tail water, ice and leaves conspired to reduce the plant's generating capacity in all seasons of the year. In the spring it was floods, summer brought droughts, leaves accompanied fall, and winter brought ice. So it all added up to keeping the present hydro-generating equipment and tying in with the local utility.

Water flow in the Hudson River at this point is controlled by the New York State Sacandaga Control Commission. Actual physical control takes place at the Sacandaga Dam, which is used by Niagara-Mohawk for hydroelectric power generation. But this dam was constructed primarily for flood control. The Commission has done much to even out river flow. But quantity and availability of water required have rarely coincided with mill needs.

New Installation. The new utility feed comes in at 33 kv. The outdoor substation consists mainly of a transformer bank on an elevated structural-steel and concrete platform cantilevered over the bay in front of the present generating room. This somewhat unique construction and location was used since this spot was actually the best place to put the transformers. It was the best location because it meant the shortest secondary run from transformer bank to the main distribution board. And with secondary distribution of 2000 amp at 480 volts, every foot of copper saved meant a considerable sum.

The power company was also happy with this location for the transformers since it offered the most convenient run for their primary feeder. Incidentally their feeder supplied a 3-phase 4-wire grounded-neutral 60-cycle service.



MOLDED CASE REPLACES OIL BREAKERS

PLANT WAS KEPT in operation during changeover. Each slate panel that formerly held ocb was removed and drilled for new molded case unit. These breakers are in the line between center of transfer switch and load. Generator leads run across top of board. An $8000 saving was made by using the maintenance crew for all work within plant

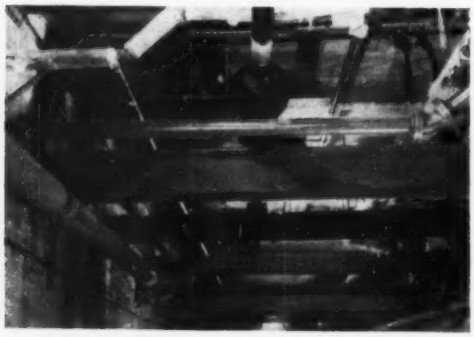
Transformers. Contrary to some present-day practice, three single-phase 500-kva transformers were used rather than one 3-phase unit. This decision, made after due consideration and not guided by initial costs alone, was somewhat unique in view of the trend toward one transformer on 3-phase jobs.

But insurance company statistics helped make this decision. Keep in mind that three single-phase transformers will guarantee a constant power source even if one of the units fails. In that case the two remaining transformers can be operated in open-delta, supplying close to 60% of total bank capacity. Incidentally, the insurance company gave a lower premium rate for *U and O coverage* when three transformers were used rather than one.

Manual Bus Transfer. General practice dictates that when purchased power and generated power are used, the two power sources be paralleled. The plant usually benefits since voltage and frequency are held constant. But in this case voltage and frequency cor-

EQUIPMENT THAT BOWED TO TIME

WATER WHEEL behind wall to left fed mechanical power direct to plant through lineshaft below. Electric motors now do job



OVERHEAD LINESHAFT, running about 200 ft, transfers power from water wheel to beaters through a series of belt drives

PLANT GENERATES OVER 2000 HP AT HIGH WATER-LEVEL

V-SHAPED DAM across Hudson River, half-mile north of United Board and Carton paperboard plant, channels water through a short canal into spillways under plant

rection were not of sufficient importance compared with all the disadvantages of parallel operation.

First off, the plant switchboard had old-type oil circuit breakers. These ocb's had an interrupting capacity far below that required for any equipment connected into a utility line. Therefore a new switchboard would have been necessary if plant and utility feeder were to be paralleled.

Second, paralleling involved some rather elaborate protective relaying equipment that would further increase the cost of a new switchboard.

Third, paralleling would require synchronizing equipment. This would be an additional cost along with increasing the responsibilities of the operating force.

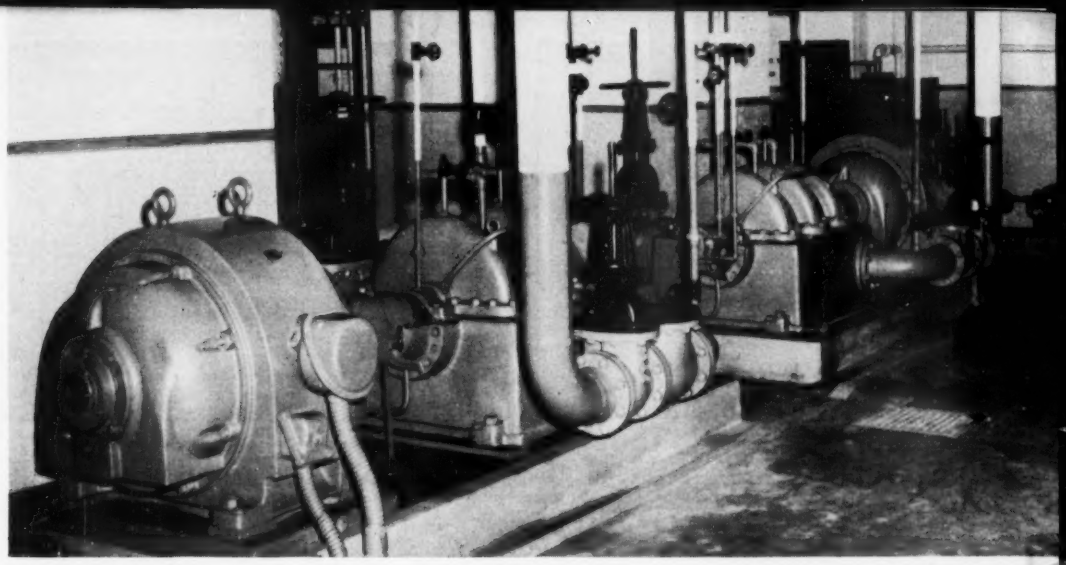
Bowing to simplification and lower cost, two separate bus systems were decided on — one for utility and the other for handling the plant. It was also felt that separate bus systems would simplify operation during an outage of utility power. And since the new system was put into operation the plant had just such an outage. It occurred during the now-famous windstorm of Nov 25, 1950. During the utility outage the plant kept operating from its own generating equipment.

This separate bus idea was handled by ganging-up double-throw switches. With any one of these seven switches in the upper position the particular plant load center is fed from the utility bus. In the lower position the local generators take over. This switching arrangement is extremely simple to operate and was economical to build. In fact, it was built entirely by plant labor at savings of about $8000.

This selective switching arrangement gives the operating men quite a bit of leeway. Plant generators can now shut down on a scheduled basis for inspection and maintenance. Planned regular generator shutdown wasn't possible before. All maintenance was on a hit-and-run basis during weekend shutdowns. Longer life should result with this new type care.

On the other hand, the transformer bank and utility feeder is sized so utility power can handle all the plant load. This is a comforting thought during low-water and ice periods.

And there's another advantage of selective switching. Through it we can tie utility power to known high power-factor loads, thereby reducing total reactive kva demand charges. This is a temporary advantage till pf is increased on all plant loads. In actual practice the plant's synchronous motors are connected to the utility power and a pf of 0.90 has been held.



CONDENSATE PUMPS. Two 3-stage centrifugal motor-driven condensate pumps are connected to the hotwell below the surface condenser. These units serve a large steam turbine in the modern central power-generating plant of a public utility

What Control for Condensate Pumps?

Successful handling of condensate from a condenser hotwell calls for the right combination of pump and control. Submergence and recirculation controls are described. Also told in detail is how to select correct size pump and control valve

By **PIO NARDONE**, *Mechanical Engineer*
Condenser Division, Foster Wheeler Corp

► CONDENSATE FLOW into a condenser hotwell varies with the load on the turbine. For the condensate pump to operate satisfactorily, hotwell liquid level, which is under vacuum, must be held within quite close limits. This has to be done while removing the varying quantity of condensate as it comes into the hotwell. To do this, some form of hotwell liquid-level control is needed.

Condensate-Level Control. Condenser hotwell liquid-level and condensate pump discharge can be controlled in several ways. Type of controls depends largely on plant-load cycle and equipment layout. Whatever the conditions, one of three basic methods is used: (1) varying condensate level in hotwell—submergence control (2) condensate recirculation (3) throttling pump discharge. Condensate recirculation is the method given chief attention here, but first let's give a little study to submergence control (POWER, Nov 1948) because under certain conditions recirculation control may revert to this type.

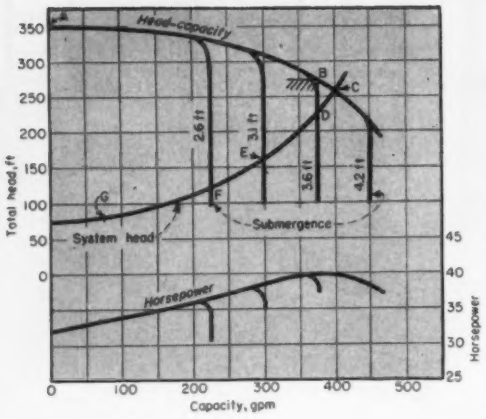
Submergence Control. Condensate pumps are generally centrifugal. For a given design a minimum net positive suction head, or submergence, is required for the pump to handle a given quantity of water. If the submergence falls below this value, pump discharge decreases. This is shown in Fig. 1, where with 4.2-ft submergence the pump delivers 400 gpm at 260-ft head, point *C*.

As turbine load drops, pump lowers the hotwell level and operates along system-head curve *CF*, at a lower submergence. For example, at 2.6-ft submergence, pump discharge drops to 225 gpm, point *F*. As submergence continues to drop, a minimum permissible capacity is reached, say 75 gpm, point *G*. If load continues to drop, a bypass line must be opened from pump discharge to the hotwell to maintain this minimum flow. This bypass must be opened during light loads and when starting, to insure minimum condensate flow through air-ejector condensers and coolers, if any, in the condensate system and through pump. When load increases, the bypass is closed and the pump rides up on the system head curve.

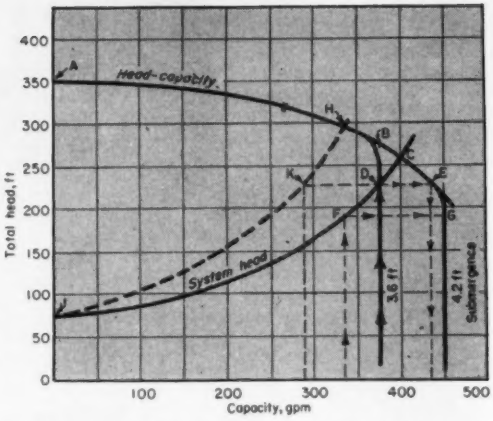
Submergence - Control Advantages. Simplicity is the chief merit of submergence control. No external controls are necessary except the bypass, which is generally closed. There is a slight power saving from operating at the capacity and head required by the system.

Against these advantages, the pump always operates under cavitation conditions. These cause noise, particularly near the knee of the break curve. Corrosion of the impeller's inlet and high shock loads on the pump's bearings is a more serious objection, because life of these parts is reduced. For these reasons this form of control is not generally used now on important installations.

Recirculation Control. A commonly



1 CHARACTERISTIC CURVES. A condensate pump requires a given net positive suction head to operate at capacity



2 RECIRCULATION. As with submergence control, the pump is selected for maximum flow and a head higher than system

used type of control returns to the hotwell part of the condensate removed by the pump. The hotwell liquid level generally controls the recirculation valve to regulate the condensate level. As with submergence control, select the pump for the maximum required flow and a head slightly higher than the system.

Thus, in Fig. 2 the system head at design capacity, 375 gpm, is 228 ft, point *D*, whereas the design head is 275 ft, point *B*. Minimum submergence recommended for these conditions by the pump manufacturer is 4.2 ft, but the pump will operate to the right of design capacity. Actual operating point is determined by the system head, the turbine load and the pump head-capacity curve for available submergence.

When submergence is only slightly higher than required for design flow, pump operates at about constant capacity along this break curve. If submergence is high enough, pump operates along the base curve *BE*, and its discharge may be quite high at low turbine loads. If submergence is 4.2 ft, the system head, at a load of 400 gpm, is 258 ft, point *C*, at which the pump operates. At this point the system head equals pump head and the unit must operate here. Recirculation is not required at this point and the recirculation valve closes.

Effects of Load Drop. When the load drops, because of reduced flow in the system, system head falls. Then the pump operating point moves out to a maximum of 450 gpm, limited by the 4.2-ft submergence. At 375-gpm load, the pump operates at 228-ft head and 435 gpm, point *E*. Under this condition the pump discharges 375 gpm to the system and recirculates 435 − 375 = 60 gpm back to the hotwell.

At 335-gpm load, system head drops to 190, point *F*, but the pump discharges 450 gpm, point *G*. To do this the pump must recirculate 450 — 335 = 115 gpm, represented by line *FG*. As turbine load decreases, recirculation increases until at zero load the pump discharges nothing to the system, but recirculates 450 gpm at 75-ft head, point *J*. From this it is evident that system head at a given turbine load determines the pump operating point and the amount of water recirculated.

Operating Changes. Several things may happen in the condensate system to change its operation slightly from that just given. A valve in the pump discharge, say at the deaerator, may be used to throttle the pump at light loads. The system head would be increased, as indicated by the dotted curve, so it crosses the head-capacity curve at *H*. Pump now operates on the base curve through a greater range before getting into the cavitation zone.

Hotwell water level may not remain constant but drops with decreased load. As a result submergence on the pump suction drops as the load decreases, and the pump operates in the break at a lower discharge than for a higher submergence. Reducing the submergence cuts down the amount of recirculation.

A third possibility is that the submergence curves may not break as sharply from the base curve as shown. This would merely affect the range of pump operation and increase the time it operates on the knee of the break curve, an unstable operating region.

Other Factors. Along with these conditions that affect the pump operation here are three facts contrary to generally accepted ideas about recirculation control.

1. Pump generally operates beyond and not at the design conditions, because pump and piping system are designed conservatively.

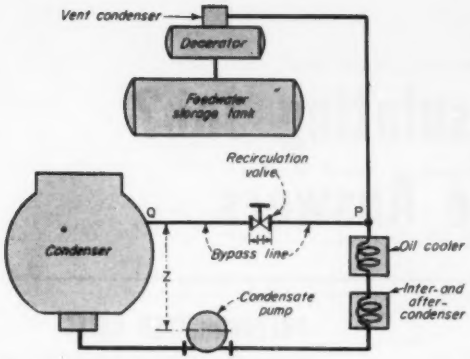
2. Pump often operates in the break region and frequently on the knee of the break as with submergence control because of load changes.

3. Recirculation valve must not be selected for the pump design capacity and head. A valve selected on this basis will be too small and, at low turbine loads, cannot pass the necessary water to hold hotwell level nearly constant. This would be as bad as no control or submergence control.

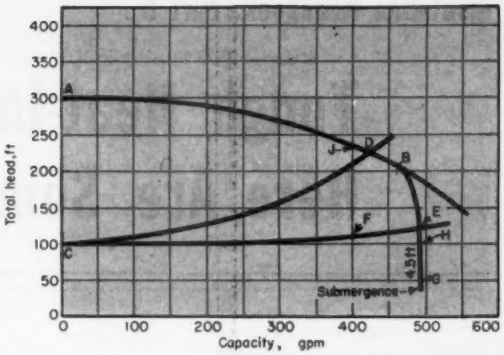
Bypass Valve Location. Whether this valve is for a recirculation, manual or automatic bypass for submergence, or throttle control, its location is the same in the bypass back to the condenser. The bypass, Fig. 3, must be connected into the pump discharge line beyond any coolers through which the condensate must pass. These include main air-ejector condensers and possibly coolers for oil, air or hydrogen.

Recirculation-Valve Selection. To correctly select a recirculation valve, plot the condensate pump's head-capacity curve with its break for normal water level in the hotwell, which in Fig. 4 we have assumed to be 4.5 ft. From zero-load head *C*, static head on the system, plot the system-head curve *CD*. When plotting this curve use the same datum as for the pump's head-capacity curve, usualy the center line of horizontal pumps and the discharge center line of vertical pumps.

Next, knowing the location of the bypass connection in the discharge



3 BYPASS VALVE. Connect the bypass from pump discharge to the condenser so that all flow passes through the coolers



4 RECIRCULATION VALVE. To select, plot the pump's head capacity curve with the break for normal hotwell level

line, point *P*, Fig. 3, compute system friction-head curve from the pump's discharge nozzle flange to this point. System-head curve *CE* is plotted using zero-load system head as a starting point. Intersection of this curve with the pump's head-capacity curve, point *E*, determines maximum quantity of water to be recirculated, 490 gpm in Fig. 4. This is the recirculation valve's capacity.

The head across the bypass line from *P* to *Q* on the condenser, Fig. 3, equals zero-load system head at *C*, Fig. 4, less the elevation to point *Q*. Head available across the valve is this value, less pressure drop in the recirculation line piping from *P* to *Q* for maximum gpm. The valve is selected for this gpm and head. If the system head curve *CE* to point *P* is quite flat and break curve *BG* has a rather sharp knee, gpm can be determined by the intersection of the zero-load system head line *CH* with the break curve *BG*.

The head across the circulation line and valve can be determined by starting with zero-load system head. If

C = zero-load system head
Z = elevation to point Q from pump datum, Fig. 3
T = head available across recirculation line including the valve
F = flow friction through recirculation line from P to Q, Fig. 3, but not the valve
H = head available across recirculation valve at maximum flow

Then, $T = C - Z$, and $H = T - F$.

Valve-Size Calculations. As an example, consider Fig. 4 as applied to Fig. 3. Pump is rated 400 gpm at 235-ft total head, point *J*, Fig. 4, and has a head-capacity curve *AB*. The system head at zero load is 100 ft, point *C*. This is the static head of the system referred to the pump datum, and generally consists of zero-load deaerator pressure plus distance from pump to deaerator connection.

Curve *CD* is the total system head at different loads. Curve *CE* represents the system head from the pump to point *P*, Fig. 3, superimposed on the zero-load system head of 100 ft. At 400 gpm, the friction head is 10 ft, point *F*, and total head to this point is 100 + 10 = 110 ft. Required pump submergence is 4.5 ft and the break curve for this submergence starts downward at *B*.

Intersection of curve *CE* with the submergence curve determines capacity of the recirculation valve, 490 gpm. Static elevation *Z* from the pump center line to *Q*, Fig. 3, is 15 ft. Friction-head loss through the recirculation line from *P* to *Q* (not the valve) for 490 gpm has been estimated to be 6 ft. Then, total head across recirculation line including the valve is $T = C - Z = 100 - 15 = 85$ ft, and head across, the recirculation valve is $H = T - f = 85 - 6 = 79$ ft. The valve must, therefore, be selected for 490 gpm at 79 ft. This would require a 3-in. valve.

Hotwell Water Level. Use normal water level in the hotwell when selecting the valve. At light loads, hotwell water level drops and reduces the pump submergence. This has the effect of moving point *E* to the left, and reduces the water recirculation through the valve. Under this condition the valve is slightly oversize, which is not objectionable.

Conversely, water level may rise above assumed normal on increased loads. Then, the recirculation valve may open slightly more than if normal water level existed, but the valve must not be smaller than determined by the method outlined. Otherwise hotwell level at light loads will drop so low the system will revert to submergence control. On the other hand, the valve must not be too large or it will not be sensitive enough at high loads when recirculation is small.

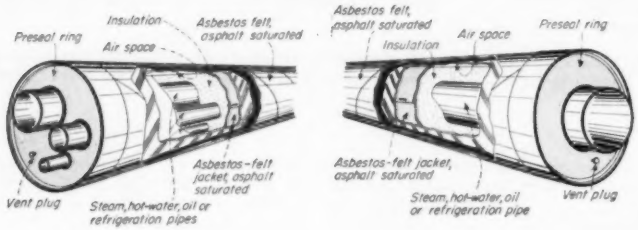
Recirculation Valve Operation. A float-operated valve responding to changes in hotwell water level is generally used for controlling recirculation. It may be directly operated by the float or pilot operated with air. The pilot is float positioned to increase air pressure to open the valve as hotwell water level drops. Springs close the valve if air pressure fails, to insure water flow in the system. The pump then goes on submergence control.

Merits of Control. Chief advantage of recirculation control is that only one valve is required to control flow into the system and insure minimum flow to oil coolers and air-jet condensers. It has the disadvantage that the pump generally operates beyond the design point and often in the break region. Under these conditions there is a power waste and the bad effects of cavitation on pump operation.

Part of the condensate is constantly returned to the condenser after being heated in the oil cooler, air-jet condenser or other heat exchangers. On entering the condenser the condensate is cooled and the heat lost in the condenser circulating water. This continuous heat loss is something that many efficiency minded operators object to.

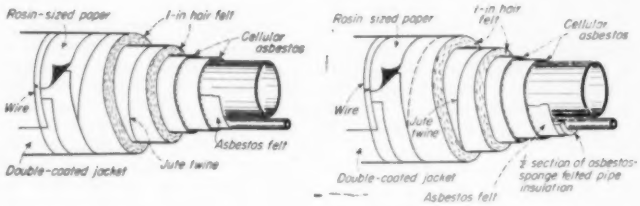
NOTE: A second article will discuss throttle control of condensate pumps and the correct size of control valve.

Tough Heat-Insulating Job? Here Are Some Answers



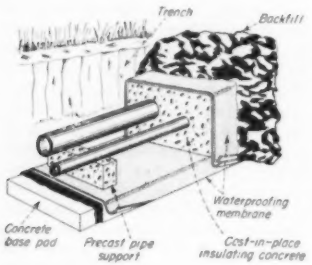
PREFABRICATED UNITS

Factory-prefabricated insulated-pipe units built to any specifications for single or a combination of pipes. Good for steam, hot water, oil and other fluids. Pipe may be steel, iron, brass or copper, any size, ends beveled for welding or threaded. Standard length is 21 ft, odd lengths made as needed. Install underground or overhead. Little field work needed



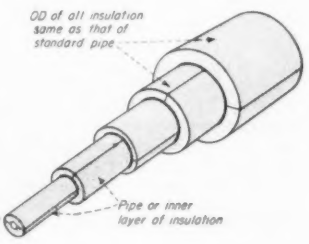
BUILT-UP HAIR FELT

For hot-oil, air or water pipes that may freeze, built-up hair felt combined with cellular asbestos does good job. Left sketch is standpipe with steam tracer; right, hot-oil line with steam tracer. Asbestos or asbestos-sponge felt used around tracer, depending on fluid conveyed. Be sure to insulate all exposed pipe and fittings that may freeze



UNDER SOIL, CAST-IN-PLACE

Cast-in-place insulating concrete good for fast, permanent insulation of underground pipes. Rot, vermin, rodent and fireproof. Install on structural concrete base for support. Precast blocks under pipe carry its weight. Parting medium, corrugated paper or special grease on pipe prevents bonding by cement. Waterproof membrane or concrete covers insulation



NESTED PIPE COVERING

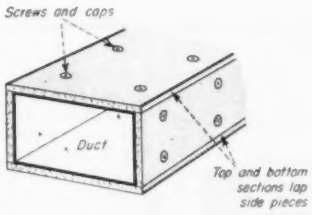
OD of each size same as OD of a standard pipe. So insulation is nestable. Increase thickness without removing original layer. Made sectional and segmental; single-layer standard thicknesses to 3 in. Double layers vary with pipe size, follow usual practices. Lightweight calcium silicate, K is 0.41, 0.54, at 100 and 500 F mean temperatures. Use at 200 to 1200 F and install like other pipe insulations. Work is easy; stock-sizes are few. Moisture and steam resistant

Run over these insulations for a quick picture of a few good ways to cut heat losses. These aren't the only types available, but they give an idea of what can be done today. Cutting heat losses is easy if you match insulation to job

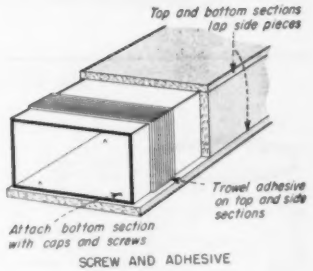
By **PHIL SWAIN**, *Editor*

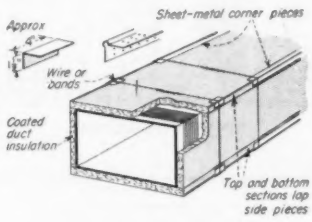
COATED DUCT INSULATION

Made of glass fibers, insulation is lightweight, fire safe, won't absorb water. Not for duct exteriors exposed to weathering unless the insulation is protected with a waterproof cover. Usual limit is 450 F. Attach insulation in any of four ways shown. Similar material is flexible, can be put on circular ducts or other parts. Use manufacturer's instructions for applying. Sketches give general details only. They are not to be used for actual construction. Coated duct insulation can also be used on duct interiors. Here it combines thermal and acoustical insulation in one layer. K is 0.23 at 75 F mean temperature

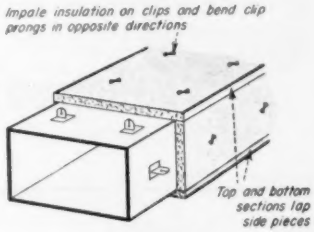


SCREW AND CAP


Top and bottom sections lap side pieces
Trowel adhesive on top and side sections
Attach bottom section with caps and screws
SCREW AND ADHESIVE



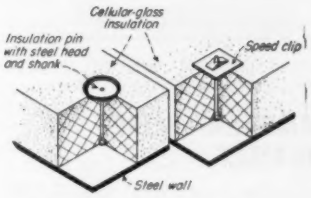
METAL EDGE AND ADHESIVE

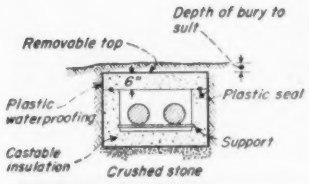


MECHANICAL CLIP

CELLULAR GLASS

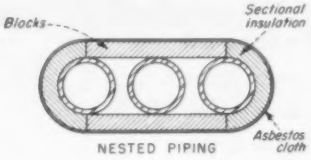
Has millions of tiny sealed cells, each filled with dead air. Good from —350 to 800 F. Use on tanks, pipes, fittings and other hot or cold power equipment. Canvas or asphalt base paint finishes give smooth exterior. Factory-wrapped pipe insulation needs no additional finish. Tank, duct and breeching fastenings shown in sketch

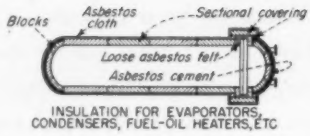


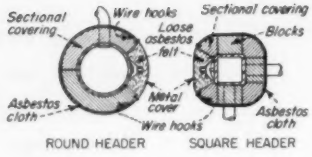


FOR CARRYING LOADS

Insulating concrete has cold crushing strength of 525 psi, can carry pipe loads. Suitable for all underground pipes. For large heavy pipes standard concrete base carries load. Insulating concrete is then used for tunnel interior. Plastic waterproofing material around exterior protects tunnel **Continued on next page**

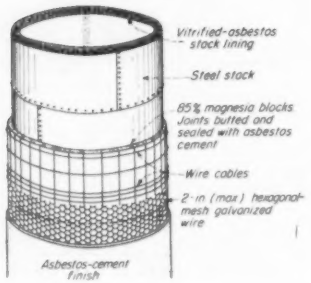


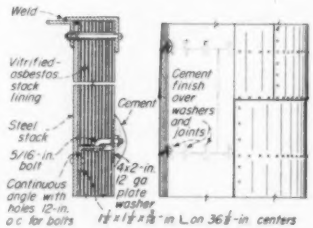




AMOSITE ASBESTOS MOLDED PIPE COVERING

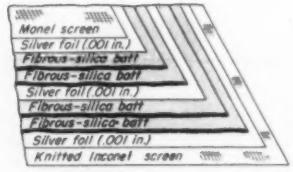
Insulation good for pipes to 1200 F. Made in half sections and cylinders to 24 in. dia, quadrants to 44 in. on special order. Material is highly fibrous amosite asbestos. Single-layer construction, felted square edges, permits easy installation, removal. Thickness to suit pipe size and temperature. Insulation has good structural strength, is water and moisture resistant. Pipe expansion is easily absorbed in an expansion joint without harming insulation





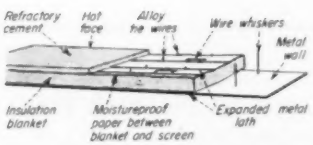
VITRIFIED-ASBESTOS SHEET

Asbestos-felts, corrugated and built up to form cellular sheets, are one of many asbestos insulations good for a variety of jobs. Sheets shown are processed and vitrified, have high moisture and temperature resistance. They make good stack and flue linings at temperatures up to 700 F. Made flat or curved, weight is about 1.8 lb per sq ft per in. thickness. Steel angles support stack lining



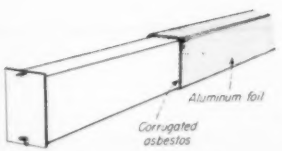
HIGH-TEMPERATURE BLANKET

Good for above 1000 F, lightweight fibrous silica has several thicknesses with various materials to cover blanket. The sketch shows one type. Use only for work above 1000 F; below this, less expensive insulation is good. Easy to install and remove. K is 1.3 to 2.4 at 1600 F mean temperature for 9 to 3 lb per cu ft blankets. Some blankets are good for continuous work to 2000 F and intermittent short-duration jobs over 2000 F. Fuses at about 3100 F



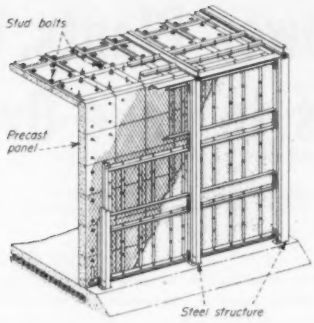
REFRACTORY DUCT LINING

Protects metal ducts from high temperatures, stops big heat loss from hot-air or gas ducts. Refractory and insulation layers are combined in one lining. Sketch shows the castable-refractory cement on duct interior. Mineral wool or other fibrous insulation is used in the blanket. Good for gases up to 950 F. Use for flues, hot-gas mains and other units conveying hot air or gas. Force insulation against metal surface so the whiskers pierce. Bend whiskers flat over the lath to hold insulation in place



REFLECTIVE ASBESTOS

Aluminum foil and ¼-in.-thick corrugated asbestos has high insulating efficiency, low emissivity. By reflecting 95% of radiant heat and by reducing conduction and convection losses, insulation is good for boilers, hot-water heaters, pipe and ducts. Use where light weight, low cost, high efficiency are important. Plain corrugated asbestos may be in direct contact with inside or outside jackets of unit insulated. So foil face is turned toward or away from the heat source



PRECAST PANELS

Refractory insulations are precast for easy assembly into many shapes. When precalcined refractory fireclay-base insulation is used, temperatures to 1800 F are allowable. The user can also cast panels; mix dry material and water. K is 0.56 at 500 F, 0.84 at 1500 F. Above 1800 F and to 2500 F plastic insulating concrete is used

SPRAYED INSULATIONS

Easily, quickly applied. Spray with high-pressure air or use trowel. One type is 65 to 75% granulated cork in matrix of gilsonite and asphalt with some inorganic fillers. Insulates, waterproofs, rustproofs, prevents condensation and resists fire. Thickness of ⅛ to ¼ in. reduces heat loss through metal 60 to 65%. Greater thickness may be costly. K is about 0.36. Good for tanks, pipes, ducts

Tips on Insulating Hot Equipment

► This article gives only a bird's-eye view of hot insulations. Constant research for better insulators in all temperature ranges permits wider selection than ever before. Today you can usually find a low-cost insulation to do your job well. Let's look over a few modern ones:

High Temperatures. Continued drive for high-output, low-cost production in all industries usually means higher operating temperatures. Insulation to cut heat loss must be used. So we find materials like calcium silicate and fibrous silica being studied for high-temperature applications. These do a good job without charring or breaking down during use.

Castable insulations with some structural strength serve moderate and high-temperature operating demands. Simple to apply, they cut costs by replacing usual enclosures around pipe and other equipment. Prefabricated insulated units for underground or overhead service are packed with any insulation specified for a given job. Machinery manufacturers march toward increased temperatures and pressures but insulation keeps right up with them. Witness gas turbines with ultra-high temperatures but fitted with good insulation for safe, dependable operation.

Simplified Dimensions. Chief complaint against insulation was never that it cost too much. Instead, people complained about installation cost. Much handwork increased job costs, required large stocks of spare insulation for emergencies. But that problem is being licked today.

Precision-made, nested insulation now fits standard pipe sizes snugly and permits adding more layers at minimum cost. Original layer needn't be removed to install second layer. Watch for more advances in this field as the idea catches on.

Installation is being studied to reduce time, effort and job costs. With today's rates for skilled labor this is mighty important when you have miles of insulated piping as found in many central and industrial stations. Aluminum foil insulations, to take just one example, can be put in with simple long-lasting staples on walls and ceilings.

How to Find It. Biggest problem today is not so much whether there is an insulation that will do a given job but where it can be found. Manufacturers' catalogs and magazine articles are the two best sources of information. Give your problem to a manufacturer; if he can't solve it he'll name someone who can.

Keep a file of new equipment items and catalogs to tell you who makes a particular insulation. Supplement these with a good book on heat transfer and insulation. It will guide you when making calculations for all usual jobs and many unusual ones. And don't forget government pamphlets giving standards for various types of insulation. They're mighty handy. Of course, POWER will keep you up to date on many insulations, both old and new. But remember we can't cover all.

Get Most From It. After buying an insulation, find how it should be installed and see that it's properly done. Follow instructions carefully and don't skimp. You must live with an insulation a long time and a poorly installed job is a headache.

Once it's in, see that your operating and maintenance crew treat it well. Insulation saves plenty of money and so rates topnotch treatment. Given proper care, heat insulation lasts many years, a silent but efficient way to put dollars in your pocket.

If Bombs Wreck Our Power Plants, Will We Have Portable Units to Take Over?

MILITARY TARGETS

1 What will the enemy aim at?

A prime object in enemy bombing will be to stop our production of war materiel. This makes our industrial areas major targets for destruction. Unfortunately many of our industries are concentrated in single areas to gain advantages of waterways, rail transportation, access to raw materials, availability of labor, etc. These advantages also influence location of central stations in addition to their desire to be near the source of load demand. Hence we find important large central stations near our industrial areas.

2 How vulnerable are central stations?

During World War II power plants were rated quite low on the target list. When they *were* bombed it was often found they could be restored to service in a short time. But these explosives were chemical—a strike by an atom bomb will be an entirely different matter. A central station can undoubtedly be knocked out to the extent that damage would take months to repair, if it is not destroyed completely. Knowing the importance of central-station supply to industry—it is very likely target circles will be adjusted to include major power plants in industrial areas.

AFTER THE ATTACK

3 What is likely to remain?

With all the effort and risk involved in making an atomic-bomb attack the enemy could afford to strike only at large areas. In big industrial cities the demolished area (several square miles) will be a minor percentage of the total. The vast untouched fringe areas will probably have an intact distribution system but may have no source of supply.

4 What about interconnections?

Capacity of tielines is only a small percentage of the total load in the majority of areas having their own power plants. Also tielines usually connect into the local system at switchyards adjacent to the local central station. Such switchyards may also be demolished making tie capacity unavailable for some time. Where ties connect in at a more remote point, they will be able to take care of only a small part of the remaining load area. It would be hard to justify increasing tieline capacity in anticipating military attacks.

5 What is the importance of undamaged areas?

Unharmed sections will be residential and commercial areas, and on the fringe there may be occasional war plants. With a dead electrical distribution system many major activities will come to a standstill. Today's lighting, heating, refrigeration, water supply, transportation and communications depend on electric power supply. All these services are minimum requirements for group living and must be maintained to prevent chaos. Morale of the population will largely depend on how livable the area can be maintained. Loss of livelihood of many by destruction of the city's main industries will exert tremendous pressure toward emigration to other parts of U.S.A. But maintenance of power services will counteract this tendency and help keep labor force in area for rebuilding.

PREPARING FOR THE DAY OF ATTACK

6 How could power supply be re-established?

Replacement of lost generating equipment means some other equipment must stand ready to pitch in. For economic reasons a duplicate generating station in the area cannot be erected in anticipation of a disaster. If it were, it would be vulnerable to attack and could hardly be counted upon as adequate insurance of supply. The answer lies in having portable generating sets of adequate size and flexibility available *before* the disaster.

7 What form should these portable sets take?

These power-generating sets must be completely self-contained and capable of traveling over roads and ferries. This means they should be mounted on trucks or trailers for immediate mobility and flexibility in placing. To operate most conveniently the mobile plants should be independent of water supply, or any other need, from their sites of operation. Their capacity should be as large as possible without interfering with mobility. Some design precedents were set during World War II in mobile plants mounted for truck, rail and marine transportation. Truck mounting appears most feasible for emergency in the interior U.S.A.

8 What type of prime mover?

Because of its dependence on large quantities of cooling water from the site and small quantity of high-grade water for makeup, the floating steam plant appears attractive for emergency service only in cities on navigable waters. An internally fired engine of either the reciprocating or turbine type seems to offer wider adaptability. Gasoline or oil engines could use conventional radiators for air cooling but this type prime mover would be somewhat limited in top capacity. It also needs fuel of fairly rigid specification for satisfactory operation. Gas turbines would probably offer the most flexibility for this type service. Simple-cycle units are compact, have a low lb-per-hp ratio which would enable them to yield a high capacity for a mobile unit. They do not need cooling water. Gas turbines can be expected to burn a wider range of oil fuels than reciprocating engines. Turbine plants would not have as good thermal efficiency as reciprocating units, but other advantages might overbalance this.

9 How many elements in a portable plant?

A portable plant may consist of three or four mobile units (1) prime-mover truck carrying prime mover, direct-connected generator, exciter, lubricating system, control cabinet

Threat of war raises the definite possibility of bombs dropping on the U.S.A. When cities get hurt, power-plant destruction may be one of the worst sore spots. Untouched surrounding areas may have no power. How can we apply first aid quickly to our stricken power systems? Here's a program for building a reserve of portable power plants that can go into service fast in disaster areas. Industrials who generate their own power need a program paralleling the utilities

(2) transformer truck carrying unit for matching generator voltage to distribution-system voltage (3) switch truck carrying circuit breakers and controls for plant; this equipment might be included on transformer truck, reducing the number of units needed (4) fuel truck, which might be of conventional tank-truck construction. All connections needed between these elements are either simple flexible hose or electrical cable. Hookup to the point of use will be simple and needs little time to make.

10 How would plants hook into distribution system?

Probably the most logical point at which portable plants would feed a distribution system would be at existing substations. This would probably require several plants operating in parallel. As for networks, it might be logical to break them up into areas that could be supplied by one or several portable plants. Advance plans should be laid out for segregating each system for a number of different eventualities so service could be restored with minimum loss of time.

WANTED—A PROGRAM

11 How should portable plants be organized?

Since this plan for service restoration is aimed at an event with a low degree of probability (we hope) it should be treated as an insurance problem. Obviously each system could not afford to provide a large percentage of its capacity in the form of portable units. Nationwide planning is needed to provide the reserve of portable plants. Studies should be made on the probable need for them over the entire country. These plants can then be acquired by individual utility companies on a prorated basis. For instance, suppose the studies showed that about 2,000,000 kw in portable plants should be provided as a reserve on a nationwide basis. If the national capacity at the time is, say, 70,000,000 kw, then the portable reserve is 2/70 or 2.9% of installed capacity. A utility system with 500,000-kw installed capacity would then acquire $500{,}000 \times 0.029 = 14{,}500$ kw in portable plants. This might be about four or five plants, depending upon what designs had been chosen. Unit kw cost would be relatively high because of small size and the need of traction power and mounting.

12 How would the plan be administered?

The utilities should run the plan as a joint project. Design of the portable plants must be such that they can connect into any utility system without field alterations. Each company will store its portable units at several locations in its own region that are not likely to come under military attack. When disaster strikes, engineers of the system affected make quick estimates of the portable capacity they need and pass that request to a central administering agency of the plan. The central agency then instructs the nearest utilities to dispatch their units to the stricken area. The plan could be worked out so each portable unit would be given specific instructions as to where to connect into the workable portions of the stricken system immediately on arrival. For obvious reasons the portable units should be stored individually at widely scattered outlying points to insure their availability and prevent their mass destruction by enemy action.

13 Who would operate the portable plants?

In any bomb attack one-third of station operating personnel will probably be lost. If the attack should take place during change of shift, this could easily become two-thirds. When the portable plants go into operation they should be operated by local personnel familiar with the bombed system. Probably only one operator per shift will be needed in each plant, making a total crew of at least three operators per plant and more likely four. This would require a large crew of operators available at each local system. In anticipation of these conditions a large number of local utility personnel in all companies should be trained in the operation and maintenance of these units. Such personnel should include many more than existing station operators, first because experienced operators stand a strong chance of being incapacitated in the disaster, and second because many more operators will be needed under emergency conditions. Emergency operators can be given regular courses of instruction directly on the portable units the utility company owns. The course of instructions must make the emergency personnel thoroughly familiar with the equipment so they can make repairs as well as operate the portable plants. Operating plan of the emergency plants should anticipate a long period of use because it will take a long time to reconstruct permanent plants to supply a damaged area.

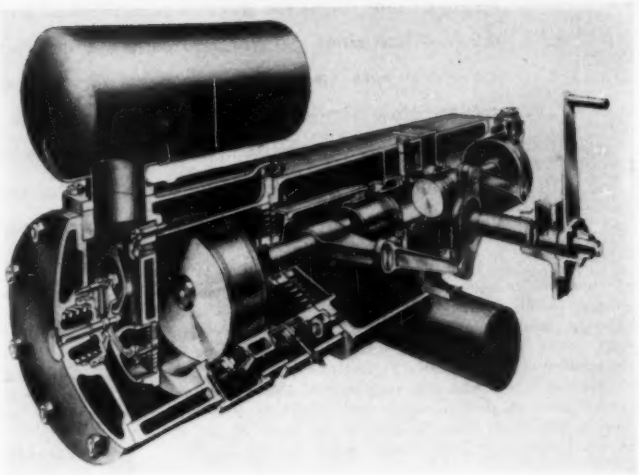
14 What other conditions should be anticipated?

Power service will be only one of many essential services severely disrupted by a bombing disaster. Workability of this plan will depend on maintenance of fuel supplies to the stricken area. Strict rationing of electric-power use on the damaged system must be worked out. Since fuel will probably be hard to deliver, only essential electric consumptions can be allowed, minimum lighting, motor drives for burners and stokers, refrigeration, cooking, water pumping, sewage-disposal plants, transportation systems, radios, telephones, telegraph, etc. Any war-product plants remaining on a system will undoubtedly receive high priority in power supply while some civilian-product plants may have to curtail operations.

Outlying industrial plants that have their own generating plants could organize a similar reserve of portable plants to meet their special problems.

Portable power-plant construction uses materials that have high value for war applications. Hence the program as proposed must be executed with an eye to conserving these materials as efficiently as possible.

CUTAWAY VIEW of portable compressor shows typical free-piston construction →

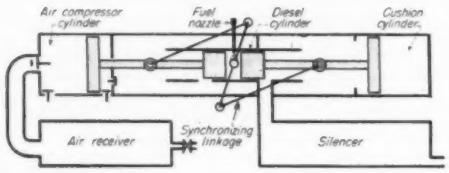


While pushing ahead on free-piston units for gas-turbine plants, French engineers are developing portable and stationary compressors. These are finding wide commercial use abroad. Here's a current report on their developments

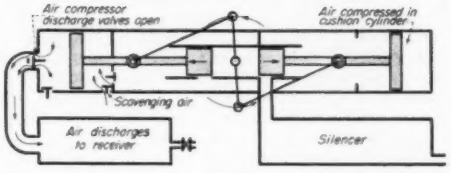
By J BARRAJA-FRAUENFELDER
Consulting Engineer, New York

Free-Piston Air Compressors Offer

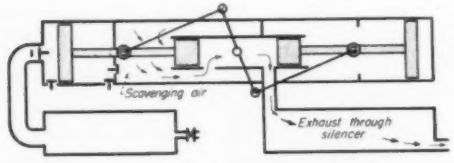
HOW THE FREE-PISTON AIR COMPRESSOR OPERATES



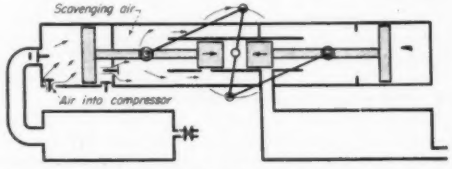
1 Free-piston unit consists of 2-cycle opposed-piston diesel cylinder, *in center*, air-compressor cylinder, *at left*, and "cushion" cylinder, at right. Synchronizing linkage connects the two piston assemblies. Fuel is injected into compressed air in the diesel, or combustion, cylinder and resulting burning causes pistons to move outward



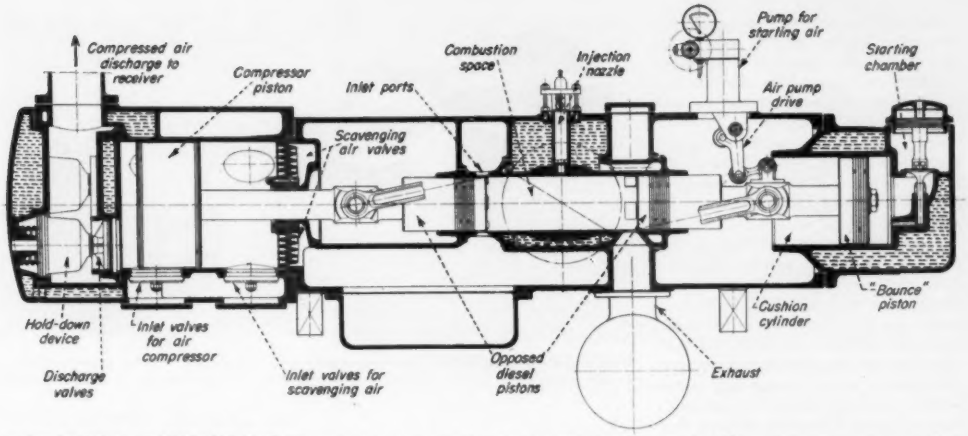
2 Large piston, *at left*, compresses air and discharges it through valves into air receiver. Fresh air is sucked into space behind inner face of compressor piston, which acts as a scavenging pump. "Bounce" piston compresses air in cushion cylinder. This stored energy, plus that of air trapped in compressor clearance volume, returns pistons



3 Toward end of outward stroke, diesel pistons uncover ports in wall of combustion cylinder. Burned gas exhausts out one set of ports (*right*) and through silencer to the atmosphere. Fresh air enters through inlet ports (*left*) from scavenging reservoir. This is filled with air under pressure by action of scavenging pump (See No. 4)



4 As diesel pistons reach outer end of stroke, pressure in combustion cylinder has fallen. Compressed "cushion" air, plus energy of air in clearance volume, causes pistons to move toward center. On return stroke, compressor cylinder refills, air is pumped into scavenging reservoir and a new air charge is compressed in combustion cylinder



CROSS-SECTION OF PORTABLE UNIT has opposed-piston diesel cylinder, *in center*, air-compressor cylinder, *at left*, and the "cushion" cylinder, *at right*. Outer face of compressor piston compresses working air; inner face acts as a scavenging pump

Practical Application Advantages

► DURING THE PAST FEW YEARS France has made great strides in developing free-piston compressors, and commercial applications are constantly increasing.

In some sizes, quantity production of these air compressors has been approached. Along with this there has been continuous work on the free-piston gas generator for gas-turbine power plants (POWER, Jan 1949, pp 79-81 and Aug 1949, pp 95-97).

Early Work. The free-piston idea is not new, of course. Pescara's work in France on devices of this kind goes back to the early 1920's. In Germany, the Junkers firm carried on development and exhibited a commercial model at the Leipzig Fair in 1936 (POWER, April 1936, pp 214-217). Many of Germany's World War II submarines carried Junkers free-piston torpedo compressors. Sulzer Bros of Switzerland published reports on free-piston units as gas generators (POWER, Dec 1942, pp 888, 889). Several firms in this country are now engaged in such development, but most interest has been shown, so far, in gas-turbine applications. Thus French activity on air-compressor designs, and commercial use of such machines in many countries, has particular interest.

Free Piston Design. Before taking a look at French designs, and seeing what advantages are claimed for them, let's review briefly the principles on which free-piston machinery operates. As shown in cutaway and section above, and diagrams at left, a free-piston air compressor consists of a central 2-cycle diesel cylinder with opposed pistons and a combustion space between. Each diesel piston connects rigidly to a larger piston on the same axis. One moves in an air-compressor cylinder (*left*) while the other, called a "bounce" piston, moves in a "cushion" cylinder (*right*).

How It Operates. Very briefly, operation is as follows: Expansion of burning fuel forces the diesel pistons apart, compressing air in both larger cylinders. Air from the compressor cylinder discharges to a receiver. Energy stored in the cushion cylinder, plus that of air trapped in the compressor clearance space, returns the pistons toward the center, compressing air in the combustion space. On the return stroke, the inner face of the compressor piston acts as a scavenging pump. Diagrams at left show the cycle of events more fully.

A linkage maintains the synchronism of the two moving assemblies so they are always equal distances from the center of the unit. Hence the pistons are not "free" in the full sense of the word. Yet load carried by the synchronizing linkage is light compared with that carried by the crank and connecting-rod mechanism of the conventional compressor. If we take a closer look at this feature, we'll see why.

Variable Stroke. A free-piston machine operates with a variable stroke. As more fuel is burned in the combustion space, greater energy is produced. The pistons are forced farther apart and more compression work is done. But the longer stroke means less clearance volume and hence less air trapped in the clearance to provide energy for the return stroke. It is for this reason that the cushion cylinder is used. The energy stored in it increases as the stroke grows longer. Design is so arranged that total energy returned by the compressor and cushion cylinders is virtually constant from no load to full load.

In a *symmetrical* design, there is a compressor piston and a bounce piston on each side. In such a balanced arrangement, the only difference in forces acting on the two moving assemblies comes from small differences in friction, leaking valves, etc. This represents the only load carried by the synchronizing linkage. The design described here is *asymmetrical*, with an air-compressor cylinder on one side and the cushion cylinder on the other. As stroke length changes, proportion of total returning force coming from each side changes. Such differences are carried by the synchronizing linkage.

Governing. It can be seen that such

a machine is governed primarily by adjusting stroke length to output needed. In actual practice, a pressure-sensitive control varies rate of fuel injection in the diesel cylinder to hold constant pressure in the air receiver. Speed is essentially constant since it depends primarily on the mass of the moving elements in relation to area of pistons. In typical units, speed may be up to 1000 cycles per min.

Construction. Cutaway and section show details of a typical unit. The diesel cylinder lies centrally in the main casting, which forms a sealed casing. Outer end of compressor cylinder has discharge valves in the head and inlet valves around the periphery. Inner end of cylinder acts as a scavenging pump. Intake valves are around the periphery; scavenging air discharges through ring-plate valves into the casing around the diesel cylinder. Synchronizing mechanism drives the fuel-injection pump. Diesel and compressor cylinder heads are water jacketed. A rotary pump circulates cooling water in a closed circuit, which includes a radiator.

To provide rotary motion for the water pump, radiator fan and a multiple-feed lubricator, a servomotor is installed. This consists of an oil pump receiving reciprocating motion from the synchronizing mechanism. It discharges to a gear pump, which operates as a hydraulic motor. Its shaft carries the water pump, radiator fan and lubricator.

Starting Methods. Most designs are air started. Pistons are first cranked to outer limits of travel. High-pressure air in the starting chamber at the end of the cushion cylinder is admitted by a discharge valve. Expansion of this air starts the pistons on their inward stroke, compressing air in the diesel cylinder. Injection of fuel then starts the unit. During the starting cycle, air-compressor discharge valves are held closed by spring pressure until receiver pressure builds up to desired level. This increases return energy of the compressor cylinder and boosts diesel compression while unit is warming up.

Air for Starting. An auxiliary starting pump on top of the casing produces high-pressure air. It is operated by a rocker and yoke from the cushion-piston train and discharges into a high-pressure-air bottle. From the bottle, air reaches the starting chamber through a valve manifold controlled by the starting crank. A high-pressure hand pump is also provided to supply air directly to the starting chamber.

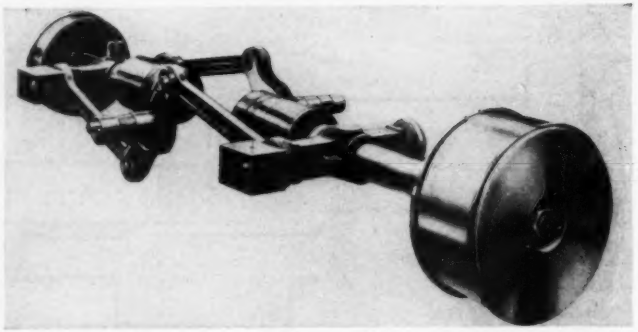
Some of the smaller compressor units have a spring-actuated starting device.

Portable Units. Free-piston machines of this design are now being built in France, under the Pescara patents, by Societe Industrielle General de Mecanique Appliquee (SIGMA), in both portable and stationary types. A typical portable unit is rated 194 cfm. Discharge pressure is 85 psi. Diesel-cylinder bore is 5.1 in., compressor is 11.8 in. Stroke varies from 7.2 in. at no load to 8.3 at high load. Speed is 910 cycles per min. Unit weighs, dry, 4620 lb. Fuel consumption at full load runs 20.3 lb per hr, equivalent to 0.37 lb per bhphr. A smaller unit, of similar design, runs 130 cfm.

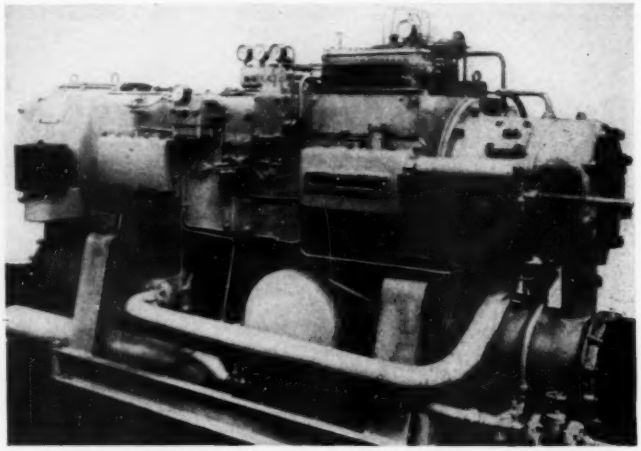
More than 2000 units of this type have been produced in the last two years, shipped to all parts of world.

Stationary Units. Two-stage compressor for 100 psi, pictured above, is rated at 630 cfm. Diesel cylinder has 10-in. bore, compressor cylinders 22 and 12.2 in. Speed is 525 cycles per min. Fuel consumption runs 54.5 lb per hr at full load. SIGMA has also designed, built and tested other types for special applications, including torpedo-charging compressors to deliver at 3550 psi.

Advantages claimed by free-piston proponents are: (1) Perfect balance with consequent elimination of vibrations (2) considerable savings in weight and bulk, particularly advantageous for portable machines (3) immediate starting, even in cold weather (4) instantaneous response, insuring a supply of air at constant pressure at any output (5) notable fuel economy with no unloading losses.



MOVING-PARTS ASSEMBLY of free-piston unit has pair of diesel pistons *(center)* rigidly connected to air pistons. Synchronizing linkage connects the two pairs



STATIONARY COMPRESSOR for 100 psi is rated at 630 cfm. Diesel cylinders have a bore of 10.2 in.; first-stage compressor cylinder is 22, second-stage is 12.2 in.

Quick Test Determines Dissolved Solids

RAPID TITRATION METHOD for determining total dissolved solids is based on ion-exchange principles and requires cation resin of high and rapid exchange capacity

Rapid, simple titration test, suitable for field or lab, gives total dissolved solids in water as accurately as the conductivity method

By **R S ROBERTSON**, *Supervisor, Water Analysis Dept*
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► DETERMINING total dissolved solids by titration is now possible with the recently developed Walker-Wise method based on principles of ion exchange. This method developed in the laboratories of the National Aluminate Corp under the direction of Dr A O Walker[1] has been adapted for field use by R S Wise.[2] It was designed for accurate determination of dissolved solids concentration in boiler water, but operators of plants using process water, concentrated by evaporation, will find it very helpful.

A small portion of analytical grade Nalcite HCR, acid regenerated and specially processed, is mixed with the boiler-water sample, Step 4 of Procedure. This converts all dissolved salts to corresponding acids, and they can then be titrated with standard sodium carbonate. Boiler-water alkalinity, though, does not convert to a titratable acid so the alkalinity figure is added to the acid-titration figure, after multiplying the titration figure by the proper factor for sample size and other considerations, Step a of Discussion. The sum of these figures is the dissolved

(*Continued on page* 194)

[1] Service Laboratories Director, National Aluminate Corp.
[2] Director, Technical Service—Cooling Water Div, National Aluminate Corp.

APPARATUS . . . Readily available, standard items

Complete test kit for dissolved solids determination by titration show in photo above. It includes:

- 1 Automatic burette
- 1 Sample reaction tube
- 1 Casserole, stirring rod
- 1 Ten-ml graduate pipette
- 1 Spatula
- Standard N/50 sodium carbonate
- Nalco special indicator solution No. 260
- Nalcite HCR, specially prepared reagent grade

PROCEDURE . . . Straightforward, easily followed

1. Cool sample to a temperature lower than 140 F.
2. Determine grains per gallon total alkalinity in the usual manner. Use Nalco special indicator No. 260 if methyl-orange endpoint is indistinct.
3. If water is highly turbid, filter or decant. Slightly turbid water need not be filtered or decanted for this test.
4. Fill tube to mark "HCR" (approximately 0.5 cubic inch) with HCR (analytical grade) and add water to be tested to mark "Water" (approximately 25 ml). Replace stopper. Mix by shaking, allow HCR to settle, decant and discard this water.
5. Again fill tube with water to be tested to mark "Water" and mix thoroughly for 30 seconds. Allow the HCR to settle and pipette 10.0 ml of the supernatant water into a clean casserole.
6. Add 3 to 4 drops of special indicator No. 260 and titrate with N/50 sodium carbonate until red color is just discharged (gray endpoint).
7. Multiply ml of sodium carbonate used by a factor of 10 and add the total alkalinity to obtain the dissolved solids reading in grains per gallon. For parts per million, multiply this figure by 17.1.

NOTE: To avoid excessive volumes of titration solution (sodium carbonate) if dissolved solids are very high, a 5.0-ml sample for titration may be used. For this, multiply ml of sodium carbonate solution required by 20; add total alkalinity for total dissolved solids.

DISCUSSION . . . Influencing factors recognized

When a 10-ml sample is titrated, the factor of 10, used in Step 7 of Procedure above, takes into consideration not only the size of sample and strength of sodium carbonate solution but also considers, for the average boiler-water sample, effects of:

a. Ionic exchange equilibrium under the test conditions.

b. Nontitratable materials, such as organic matter and silica that are normally present in boiler water.

c. Results, which must be in terms of concentration of the actual constituents, not in terms of calcium carbonate.

d. Ratio of sulfate to chloride ion concentration.

CONCLUSIONS . . . Results accurate, reproducible

Tests by this method on a large number of boiler-water samples gave results quite close to those by gravimetric dissolved solids determinations. Results by the exchange-titration method can be reproduced within 3%.

1 Present-day textile plants make heavy use of air-conditioning for production control and laboratory research. When the Hightower Textile building went up at Georgia Tech they decided to give it the most modern mill conditions possible

Hightower Textile Building

Air conditioning a 2-story textile mill for loads like spinning, carding, knitting, twisting and winding of a range of fabrics requires a highly flexible system. Here's how Georgia Tech did the job and added comfort conditioning to it as well

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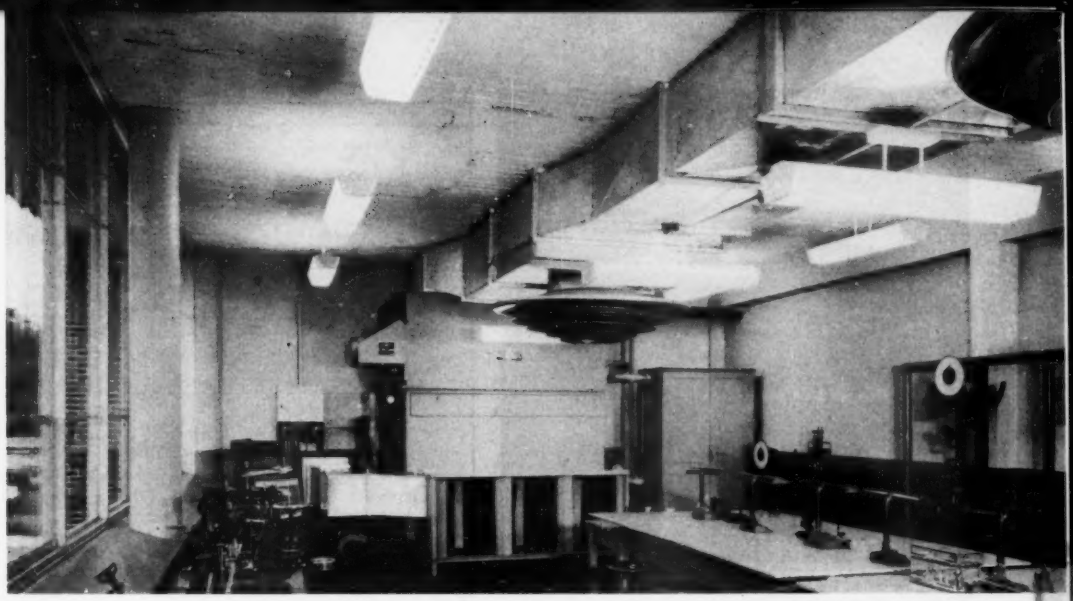
3 More or less modified "unit system" solves wide variety of loads. Separate conditioners in mill area and comfort zones handle load *Photos, courtesy Anemostat Corp*

► TEXTILE ENGINEERING involves a full understanding of the whole range of fabrics in use today—cotton, rayon, jacquard, silk wrap. To give students this working knowledge in up-to-date surroundings the Board of Regents of the University of Georgia authorized construction of the Hightower Textile Engineering Building on the campus of Georgia Institute of Technology, Fig. 1.

Textile plants make heavy use of air conditioning both for production control and laboratory research. So this new building is fully air-conditioned with a plant that maintains within very close limits optimum temperature and humidity conditions in all departments regardless of prevailing weather.

Let's look at the air-conditioning load to be met. Hightower Textile Engineering Building consists of three major sections: (1) 3-story class room, office and exhibition gallery area forming



2 Aspirating-type diffusers in the ductwork deliver air to all conditioned spaces like the laboratory above. These aspirators have equalizing dampers and blanked off bafflers to give even distribution and a uniform temperature throughout

Conditions Air for All Fabrics

the front end of the main mass of buildings (2) 2-story mill area where various textile operations are carried out (3) 300-seat auditorium in an L-shaped section at the front.

Originally a total of 300 tons of refrigeration was planned to meet the combined load of laboratories and comfort conditioning. But the expected construction and installation costs ran so high a plan was worked up to spread out routine operations and hence cut down total refrigeration load. That way a 150-ton installation could handle the building, table on p 91.

As this table shows, the 15 principal areas or zones to be conditioned represent a wide variety of loads covering variable time periods. For these reasons a more or less modified "unit system" was put in. There are 13 separately operated conditioners in the mill-area and two comfort units for the office and auditorium load. All draw their chilled water from a central refrigeration plant.

Refrigeration Plant. This central plant has a motor-driven 150-ton centrifugal compressor that uses Freon 11 as the refrigerant. It handles 350 gpm of water and cools it from 54.3 to 44 F. The water cooler is a horizontal, multipass shell-and-tube heat exchanger, 28 in. in diameter, and 12 ft, 6 in. long over the tube sheets. Between refrigerant condenser and water cooler is an interstage liquid cooling flash chamber. It subcools the liquid refrigerant before it reaches the evaporator.

A double-helical speed-increasing gear assembly with a ratio of 2.85 to 1 goes between the motor and compressor shafts. When the compressor runs at 5000 rpm with suction temperature of 36.8 and condensing temperature of 101.6 F, it develops the rated 150 tons of refrigeration.

The compressor works through a number of electrical controls. For instance, a nonreversing drum switch designed for slip-ring motors regulates speed as well as starting and stopping. Through a speed regulation the compressor capacity during light loads can be held in check.

The drum switch also controls, through resistors, the secondary current but not the primary. An interlocking arrangement, however, permits closing the magnetic primary only by the pushbutton station when the drum switch lever is in "off" position. This gives "no voltage" protection. By putting proper relays in the primary control circuit, full overload protection can be had.

A second interlock between the compressor and chilled-water pump-motors shuts down the compressor when the pump is not running. This prevents freezing the water in the chiller if the circulating pump breaks down.

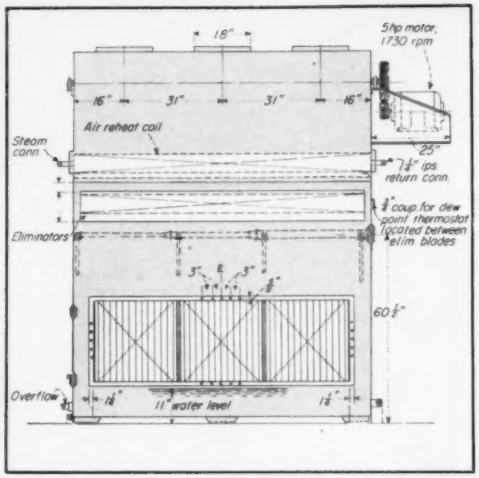
An automatic suction damper, which throttles compressor suction and, therefore, capacity, maintains a constant leaving temperature for the chilled water under light loads.

Purge System. To keep the Freon system free of water, air or other noncondensable gases, a unified purge and recovery setup has been installed. It consists principally of a 1-hp motor-driven compressor and a system of piping to collect noncondensable gases from the upper section of the refrigeration condenser and discharge them to atmosphere. The operator has to start and stop the purging compressor manually.

The Freon discharges from the 150-ton multistage compressor directly to a horizontal multipass shell-and-tube condenser mounted above the water chiller. This condenser has a steel shell 18 in. in diameter and 12 ft, 6 in. over the tube sheets.

About 500 gpm of condensing water goes to an induced-draft cooling tower on the building roof for reuse. The tower stands only 15 ft., 6 in. high and is 16 ft wide by 18 long; dry weight totals 46,000 lb; wet, 57,200. Its design is

4 Return air to the thirteen mill units goes through dry-type low-resistance filters with removable lint screens above



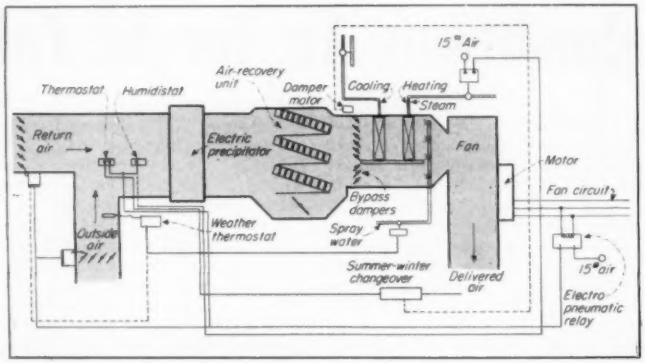
5 Chilled water for individual units comes from a central refrigerating plant, through modulating valves to sprays

based on water delivery at 95 F and leaving temperature of 85 F with the atmosphere at 78 wet bulb.

Air Handling. Except for three of the unit air conditioners supplying the laboratories all receive fresh air through a single fresh-air intake in a penthouse on the roof. This incoming air passes through an electrostatic precipitator. It has an air-handling capacity of 10,400 cfm and a cleaning efficiency of 90% based on a blackness or discoloration test for normal atmospheric air.

The main fresh-air duct from the penthouse to the individual conditioners runs along the top of the upper-floor corridor. To prevent uncomfortable temperatures in this corridor during the cold months a preheating coil has been put in this duct. Control of the air temperature leaving the preheating coil is accomplished by a double-seat modulating valve in the steam-supply line.

This air then undergoes conditioning in the individual units and is distributed through that unit's zone only. Aspirating-type diffusers, in Fig. 2, 3, in the ductwork deliver air to the conditioned space. These aspirators have equalizing dampers and blanked off bafflers to give even distribution and a uniform temperature throughout the area served. Each diffuser contains six cones or flaring members. The cones have different dimensions and contour. They are so related to one another that they put out many interlocking planes or blankets of warm air at different angles, and they equalize temperature and motion.



6 Auditorium comfort-conditioning unit brings in its own fresh air and mixes it with the return air; then passes the mixture through an electrostatic precipitator

Return air to the 13 mill units, described below, goes through dry-type low-resistance filters held in a VO-type master frame. These permanent cleanable filters have 13.3 sq ft of active filtering area per cell. A removable lint screen separates large lint particles. A special filter cleaner driven by a 1-hp motor provides periodic cleaning. It supplies an air stream at an air velocity of 403 fps.

Mill Areas. There are 13 individual air-conditioning units, Fig. 4, for the different mill areas because the fabric handled represents different air-conditioning loads, table on p 91. As previously mentioned chilled water for these conditioners comes from the central refrigerating plant.

This chilled water enters each conditioning unit automatically through a modulating valve in the branch cold-water supply line of the unit and then goes to the saturating sprays.

These sprays perform an important job. By achieving a high degree of saturation of the air stream the dew point can be closely controlled. Actual temperature of the saturating spray can be lowered through the cold-water modulating valve, or raised by adding heat to the water collected in the base unit.

PRINCIPAL DESIGN AND OPERATING FACTORS
TEXTILE BUILDING'S AIR-CONDITIONING SYSTEM

Unit	Room temp	Rel humid	No. of people	Lights, watts	Mill motors, hp	Unit fan motors, hp	Unit pump motors, hp	Outside air, cfm	Int sens heat	Total load Btu/hr	Winter steam Btu/hr	Min dew point	Tons of refrig	Hours during day
Auditorium Trane 2-18	—	—	300	—	—	5	—	—	—	250,000	—	—	28.2	As scheduled
Dept heads' office Trane 2-12	—	—	—	—	—	2	—	—	—	162,400	—	—	13.5	As scheduled
Cotton loom Niagara 475	75-80	70-80	50	12,500	10.5	15	7.5	1000	225,469	288,769	750,000	64.5	24.1	—
Jacquard loom Niagara 460	70	55-70	40	6,400	6	7.5	5	700	138,530	199,630	500,000	53	16.6	Variable
Silk warp & creel Niagara 433	70	60-70	12	2,400	5	5	3	500	87,150	122,690	350,000	55.6	10.2	Variable
Cotton picker Niagara 423	75-80	50-60	12	1,100	15	3	3	400	127,196	148,856	250,000	55.2	12.4	Variable
Cotton card Niagara 485	75-80	50-65	100	4,800	22	15	7.5	1500	295,260	415,260	750,000	55.2	34.6	—
Cotton spinning Niagara 475	75-80	60-70	50	2,400	20	10	7.5	800	199,520	264,420	620,000	60.2	22.0	—
Knitting Niagara 433	70	60-70	35	3,300	4	5	3	500	122,880	165,568	350,000	55.6	13.7	—
Wool carding Niagara 433	70	65-70	12	1,800	10	5	3	600	105,100	143,190	350,000	57.8	11.9	Variable
Twisting-winding Niagara 475	70	65-70	50	2,500	17	10	7.5	600	190,640	251,540	620,000	57.8	21.0	Variable
Spun filament, rayon Niagara 475	70	60-70	35	1,900	5	10	7.5	500	130,840	184,860	620,000	55.6	15.3	Variable
Spun rayon Niagara 433	70	50-65	30	1,600	10	5	3	400	121,730	159,970	350,000	50.2	13.3	Variable
Rayon picker Niagara 432	70	50-65	12	1,100	5	2	2	300	73,482	99,002	200,000	50.2	8.25	Variable
Physical testing Niagara 433	70	60-70	15	2,400	3	5	3	150	113,265	132,715	350,000	55.6	11.0	—
Capacity-refrigerating compressor						140 Full load								150 tons, total

Here's how these individual conditioners are controlled: (1) When the circuit to the fan is energized, the electric pneumatic relay connects central-duct air to the system. (2) As temperature at the eliminator plates above the spray rises, the dew-point control bulb closes the steam valve to the water-heater coil in the sump. (3) If temperature at this point keeps going up, the chilled-water valve gradually opens. This permits blending chilled water under pressure at 45 F with gravity-flow water from the sump. The mixture then goes to the pump and to the sprays. (4) A thermostat bulb in the return-air stream modulates steam flow to the upper, reheat steam coil to meet required dry-bulb temperature in the room. (5) For winter operation steam flows to the coil in the sump to warm the spray water. Amount of steam and hence degree of warming is controlled by the bulb at the eliminator plates to meet the desired wet-bulb reading. Incidentally, a float valve on a city-water line maintains constant water level in the sump when humidity is being added to the room. (6) Reheat steam coil with its bulb in the return-air stream holds dry-bulb temperature in the room at a steady level. (7) For summer operation both steam lines stay closed unless a slight reheat is needed after establishing a low dew-point temperature below in the sprays. Then sufficient reheat is added to keep room from under-cooling.

Comfort Conditioning. Two individual unit conditioners handle the comfort-conditioning load for auditorium and office. Auditorium unit is one of the three that does not get its outside air from the penthouse intake.

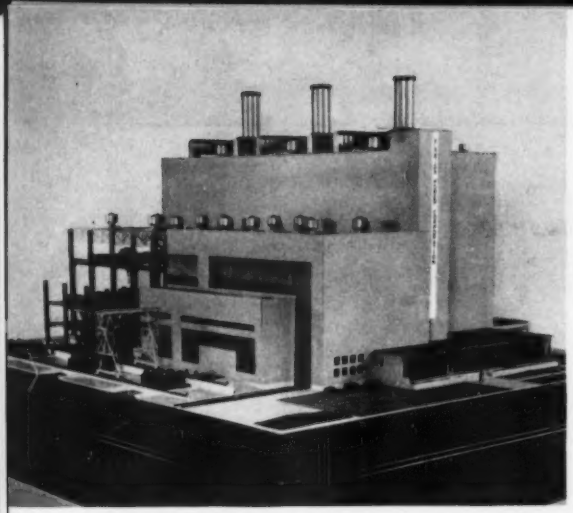
Instead, Fig. 6, it brings in its own and mixes it with return air. The mixture goes through an electrostatic precipitator, followed up by a bank of canisters charged with activated carbon. This activated carbon serves as a deodorizing agent and permits a higher use of return air.

Since a higher percentage of return air is thus made fit for reuse, less outside air is added which, in turn, reduces refrigerating effect. This saving is better appreciated when you remember that one of the principal heat loads in a comfort-conditioned area is the sensible and latent heat thrown off by the people in the area, and normally wasted.

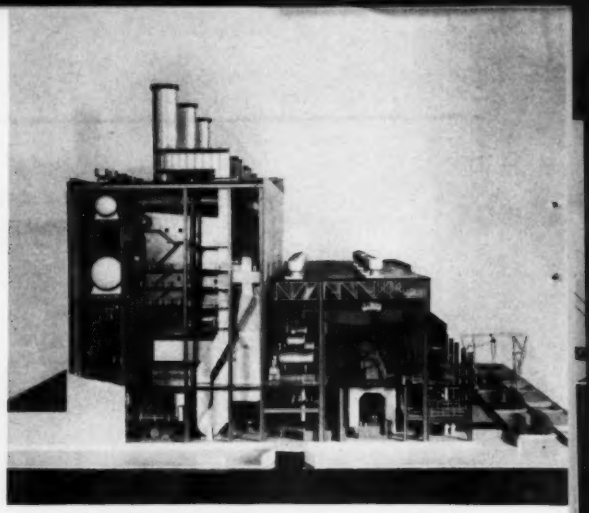
The conditioned air passes under the floor of the auditorium through a concrete duct that was cast integral with the floor. This duct connects to vertical risers and they feed the supply ducts on either side of the stage. Grilles introduce air to the auditorium. Return grilles in the opposite end wall pull the air out.

A manual summer-to-winter change-over switch provides for heavy seasonal changes. When heat is added to the incoming air a humidistat energizes an electrically-operated solenoid valve to automatically turn city water into the water spray header.

Acknowledgments. Behind so elastic a job in design and the solution of the problems such a setup raises, there had to be a good degree of cooperation. No report of the system design would be complete without such recognition. The author wishes to acknowledge the help of the architectural firm, Bush-Brown, Gailey & Heffernan, who designed the building as a whole, and Colonel Blake R Van Leer, president, Georgia Institute of Technology, C L Emerson, vice-president, and H A Dickert, director of the textile school.



ULTIMATE STATION will have three units, each consisting of one boiler feeding one turbine. Building resists 110-mph wind



ONLY MECHANICAL EQUIPMENT located outdoors are circulating pumps and trash screens, at right, served by the gantry crane

BOOTH POINT Eyes Fuel Flexibility

Newest plant of Florida Power Corp, totally enclosed, has central control room, which required no increase in building size. Boilers to be initially oil fired are laid out for possible future conversion to pulverized-coal burning. Adequate space is provided for installing future coal bunker, pulverizers, ash pits

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► Florida Power Corporation's latest power station, Booth Point, stands about three miles south of Oldsmar, Fla., on the west shore of the Booth Point peninsula. This neck of land extends into Tampa Bay.

The plant will use the unit system with a single boiler feeding a turbine. Initial installation has a 450,000-lb-per-hr boiler feeding a preferred-standard 40,000-kw turbine scheduled for operation in May 1951. Two similar units will bring the station to an ultimate capacity of 120,000 kw. The second unit is scheduled for 1953 operation.

A railroad delivers heavy materials to Oldsmar. From here trucks carry them to the station. Barges will deliver fuel oil to the plant.

Oil Handling starts with fuel delivery to the Florida Power Corp's Port Tampa Oil Terminal. Barges transship the oil to Booth Point. A transfer pump in the pump house at the dock passes the oil from barge to a 55,000-bbl storage tank. Two fuel-oil booster pumps in parallel forces the oil to the boiler room. Steam coils in the storage tank heat the oil during cold-weather months.

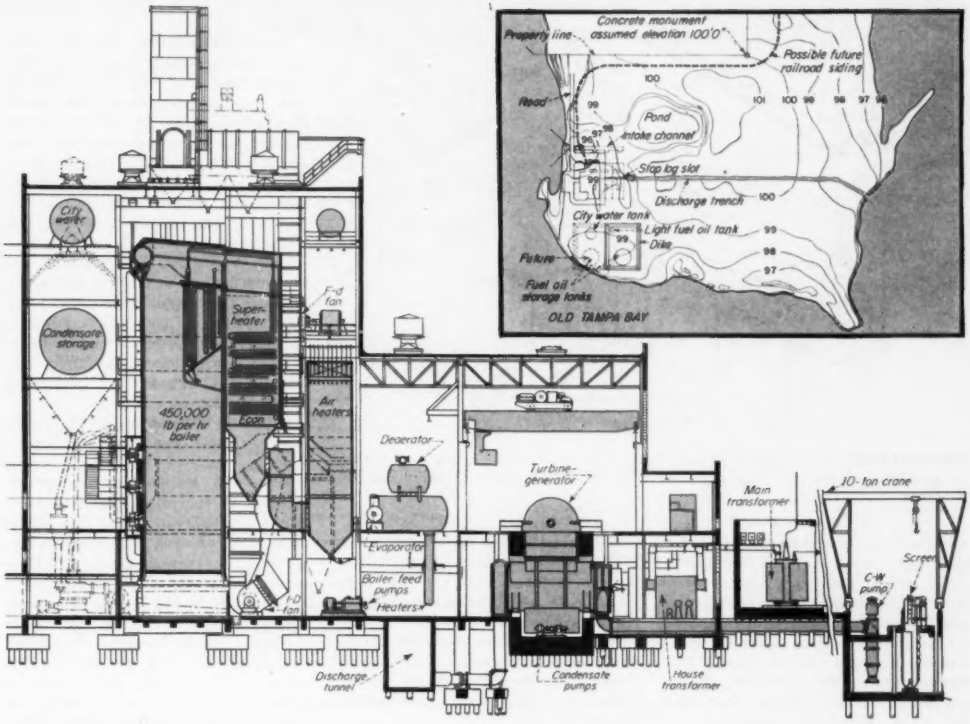
Centralized Control. Nerve center of the station is the centralized control room. It stands on the operating floor between boiler and turbine rooms. This results in the shortest possible connections for mechanical and electrical control lines. In addition, operators have ready access to all major equipment. The building size was not increased to provide for this separate control room. Centralized control (1) minimizes size of operating crew (2) makes all pertinent data available at one point (3) allows operator to make corrective actions in emergencies for several operations simultaneously (4) minimizes communication errors (5) requires higher-type personnel with resulting improved operation.

Glass walls on three sides of the air-conditioned control room give clear views of both boiler and turbine rooms. High-intensity lighting is arranged to avoid glare and shadows. Luminous ceiling of plexiglass panels has slimline strip lights mounted above the glass. Auxiliary holophane asymmetrical units direct light on the control panels.

Turbine, boiler and duplex switchgear panels are all in the control room. Turbine and boiler panels, along north and south walls, respectively, face each other. Duplex switchgear on the west side is arranged in a horseshoe shape. Space at both ends of the duplex-switchgear will accommodate future additions for Units No. 2 and 3.

Turbine and boiler panels contain all the steam-pressure gages, temperature recorders, flowmeters, combustion-control elements, pump-control switches, annunciators, alarms, meters and instruments necessary to give the operator complete control of the turbine and boiler.

Circulating Water. Plant location on a peninsula eliminates the possibility of cooling water recirculating from discharge back to the intake. Map, right, shows the intake channel running east about 200 ft along the north side of the



INITIAL INSTALLATION has one 450,000-lb-per-hr boiler supplying 1250-psig 950-F steam to preferred-standard 40,000-kw turbine. Map above shows location of station on Booth Point peninsula and 1600-ft discharge canal for cooling water

plant. The open-discharge channel runs about 1600 ft all the way across the peninsula to the east shore.

The intake channel has been carried up to the end of the present building but will be extended as future units are added. Elevation at bottom of the intake channel is 82 ft 6 in., and the lowest extreme-low-water level at times of hurricane has been recorded at 87 ft 6 in. Each circulating-water pump has a separate intake well with an individual traveling water screen. Gates on intake-well inlet and on partition wall between wells allow maintenance work to be done on either screen while water to both pumps passes through the other screen. The roadway bridge crossing the intake channel at the mouth has an apron-type construction, which keeps floating trash from entering. A 10-ton traveling gantry crane facilitates maintaining circulating-water pumps and screens.

The discharge tunnel of reinforced concrete runs under the ground floor beyond building limit for the future two units. Elevation at bottom of the tunnel is 83 ft 6 in., but at the end of the tunnel it rises to 87 ft 6 in., forming a pocket. Even at times of lowest water this pocket will maintain a seal for circulating-water piping.

Future Coal Burning. Plant design allows easy conversion to future coal burning. At present it will burn bunker-C oil. Pulverized coal-burning equipment can be installed without any major change in building or equipment. Coal bunkers, scales and pulverizers can be put in the south end of the building, see above. Space is also available for boiler ash hoppers, flyash hoppers in air preheater and last passes of boiler, and both mechanical and electrical dust collectors. For coal burning the same boiler fans will be used but the induced-draft-fan motors will be replaced with ones of greater horsepower and speed.

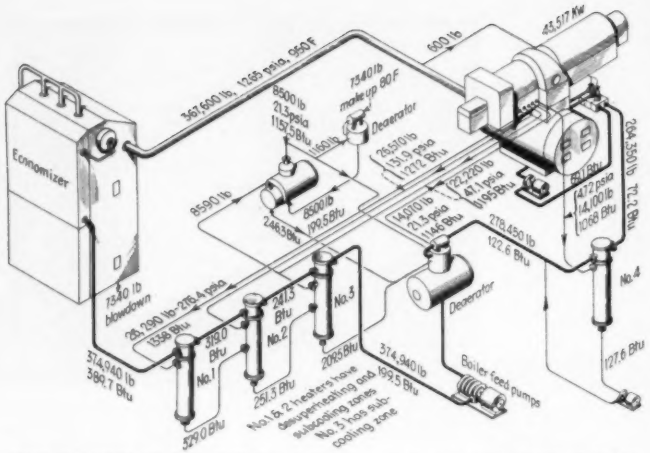
Steam Generator. Superheater outlet steam temperature remains constant at 950 F from 300,000 to 450,000 lb per hr by adjusting the gas bypass control. Full-load feedwater temperature is 416 F. Furnace-heat liberation reaches 21,200 Btu per hr per cu ft at rated output.

Steam soot blowers serve the boiler and superheater and air soot blowers clean the economizer and air preheater. All soot blowers are the automatic sequential type.

Automatic combustion controls maintain steam pressure and temperature by regulating fuel supply and the forced- and induced-draft fans. Electrical interlocks between oil supply and the boiler fans guard against mishaps from failure of any or all the fans. If one i-d or f-d fan fails, the remaining companion fan can carry 60% of rated load on the boiler.

Main Turbine. The turbine has 21 single-row and 3 double-row stages. The five extraction points are at the 5th, 8th, 13th, 16th and 19th stages.

A head tank under the roof supplies cooling water to hydrogen, seal-oil and turbine-oil coolers. Two 550-gpm and one 340-gpm pumps circulate conden-



HEAT BALANCE OF SINGLE-UNIT installation uses all five bleed points of turbine to feed five heaters and evaporator. Makeup deaerated ahead of the evaporator

sate through these three coolers and a/ heat exchanger in a closed circuit. Normally one of the larger pumps circulates water through the hydrogen cooler and the smaller pump through the oil coolers. The remaining pump serves as standby for either active pump. This arrangement permits regulating flow to individual coolers without disturbing flow to the remaining coolers.

The main-condenser deaerating hotwell has a capacity of 1500 gal. Two horizontally divided centrifugal condensate pumps can each handle 600 gpm against a total dynamic head of 225 ft. Throttling the condensate-pump discharge maintains the condenser hotwell level. A controlled recirculation line connects the pump discharges and the hotwell. This system prevents cavitation, maintains uniform hotwell level and prevents pump overheating.

Feedwater. Drilling a test well and making a thorough economic study of water supply showed the best source for boiler makeup would be the city-water main at Oldsmar. Water flows from this main through a 4-in. transite pipe to the outdoor 1,000,000-gallon city-water storage tank. Two pumps transfer the water to a cold well in the boiler house through a zeolite softening system of 1500-gph capacity. The treated water then passes to the make-up deaerating heater on a platform directly above the evaporator. From here the water flows by gravity to the evaporator.

Three half-capacity barrel-type boiler feed pumps deliver feedwater from the main deaerator through three high-pressure heaters to the economizer. One pump acts as standby during full load conditions. Pumps are double volute design, which balances all radial loads throughout the entire operating range. Using 4 to 6% chrome-alloy steel in the intervolute case and 11.5 to 13% chrome alloy in the rotor protect the pump against corrosion and erosion. Automatic recirculation bypass controls protect the pumps during low-load operation.

A 10,000-gal condensate head tank takes care of varying rates of condensate flow. Rise in deaerator level automatically closes the regulating valve and allows the head tank to take surges in the system. The head tank overflows to a 5000-gal condensate sump tank below the ground floor. Low water in the head tank starts the condensate transfer pumps to pass water back up to the head tank until the correct level is restored. An additional 50,000 gallons are held in a condensate storage tank tied into the system for maximum flexibility.

Building exterior is finished in 5x12-in. unglazed buff tile while the stair tower is in green. Building has been designed to withstand all normal loadings plus the effect of 110-mile-an-hour hurricanes.

The ventilation system passes the maximum possible amount of outside air through the building. The only openings are louvered. These are near grade level and pass air into the building. Roof ventilators discharge this air. Windows are not desirable because of high winds and hurricanes. A low wing across the building front houses offices, machine shop and lobby. Natural light enters these areas. The offices are air conditioned so no operating sash are needed.

Electrical Equipment. The main hydrogen-cooled generator ties into its transformer bank just outside the building wall through an isolated-phase metal-enclosed bus duct. An air-blast circuit breaker on the operating floor can separate the generator from its transformer bank. A 3750-kva station-service transformer taps into the bus on the generator side of the breaker. This transformer supplies the station auxiliaries. A second 3750-kva transformer ties into the bus on the line side of the breaker. This standby transformer supplies starting up and reserve power to all station auxiliaries. The two future generators will connect directly to their transformers without any intervening circuit breakers.

Station auxiliaries are all electrically driven. Total connected load equals 4500 hp. Each of the larger essential motors, 100 hp and above, connect through an individual circuit breaker to the 2300-v switchgear. This equipment is metal clad, with drawout-type air circuit breakers, in the electrical bay on the north side of the turbine room.

Motors, 50 to 100 hp, are 440 v, connected through individual electrically operated circuit breakers. The 440-v switchgear is on a gallery between ground and operating floors. Smaller 440-v motors connect to a combination magnetic starter with circuit breaker in a motor control center. These motors are arranged in four groups, each group connecting to a motor-control center. Each control center connects to a breaker on the 440-v bus. A reactor in the lines feeding the control center limits short-circuit current at the control center to 15,000 amp. This permits use of molded case circuit breakers.

Electrical control of the station centers on the tunnel-type duplex control board in the centralized control room. This board contains the controls for generator, exciter, spare exciter, station service transformers and the outdoor substation. All indicating instruments and switches mount on the front panels, with relays and recorders on the rear. All relays and watthour meters are the drawout type with built-in test devices.

A 60-cell storage battery, rated 564 amp for 1 min down to 1.75 v per cell, supplies 125-v control power for the entire station, including the outdoor substation. Two 3-kw motor-generator sets charge the battery. One floats on the battery at all times while the other one stands by.

An automatic-dial telephone system provides intercommunication means within the station. There are 19 telephone stations throughout the plant.

PRINCIPAL POWER-PLANT EQUIPMENT

Unit No. 1, Booth Point Plant, Booth Point, Florida, Florida Power Corp

STEAM-GENERATING EQUIPMENT:

Boiler, 1 ..... Babcock & Wilcox Co
450,000 lb per hr continuous, 1315 psig, 950 F, radiant furnace, single drum, 2313-sq-ft heating surface, 26,030-cu-ft furnace, 21,200 Btu per hr per cu ft heat release, 5816 sq ft waterwall surface, oil fired, provision for future pulverized coal

Superheater, 1 ..... Babcock & Wilcox Co
Continuous-tube pendant type, 2-section, center gas bypass control, 16,122-sq-ft heating surface

Economizer, 1 ..... Babcock & Wilcox Co
Continuous type, counter flow, 3-section, 10,900 sq ft

Air heater, 1 ..... Babcock & Wilcox Co
Twin tubular, two gas passes, three air passes per section, 96,600 sq ft surface

Soot blowers: automatic; air, steam ..... Diamond Power Specialty Corp

Forced-draft fans, 2 ..... American Blower Corp
62,100 cfm, 8.3-in. water, 80 F, vane control, outlet damper

Forced-draft fan drives, 2 ..... General Electric Co
250 hp, 720 rpm, 3-phase, 60 cycle, 2300 v, direct-connected splashproof induction motors

Induced-draft fans, 2 ..... American Blower Corp
105,000 cfm, 6.0-in. water, inlet louver control, outlet damper

I-d fan drives, 2 ..... General Electric Co
300 hp, 720 rpm, 3 phase, 60 cycle, 2300 v, direct connected, splashproof induction motors

Steel stack, 1 ..... R D Cole Manufacturing Co
Self-supporting, 50 ft high, 12-ft 6-in. dia

Ducts and breeching ..... Connery Construction Co

Combustion control and instruments ..... Republic Flow Meters Co

POWER-GENERATING EQUIPMENT:

Turbine-generator, 1 ..... General Electric Co
40,000 kw preferred standard, tandem compound, double flow, 1250 psig, 950 F, 2 in. Hg abs, 47,058 kva, 3 ph, 60 cycle, 13.8 kv, 3600 rpm, hydrogen-cooled generator

Condenser, 1 ..... C H Wheeler Manufacturing Co
Surface type, 32,500 sq ft, single pass, divided waterboxes, spring supported, twin-element 2-stage air ejector, inter- and after-condenser, one priming air ejector

Circulating-water pumps, 2 ..... Fairbanks, Morse & Co
Single stage, propeller, vertical, 28,300 gpm, 14.35-ft head

Circulating-water pump drives, 2 ..... General Electric Co
125-hp 450-rpm 3-ph 60-cycle 2300-v totally-enclosed induction motors

Traveling water screens, 2 ..... Link-Belt Co
30,000 gpm, 8-ft 6-in. trays, stainless-steel cloth

Traveling-water-screen drives, 2 ..... General Electric Co
1-hp 1800-rpm 3-ph 60-cycle 440-v totally enclosed induction motors with speed reducers

Condensate cooler, 1 ..... Griscom-Russell Co
Divided waterbox, 5033-sq-ft surface

Cooling-water pumps, 3 ..... Allis-Chalmers Manufacturing Co
Two 550-gpm 70-ft-head pumps, close coupled to 15-hp 1750-rpm 3-ph 60-cycle 440-v splashproof induction motors. One 340-gpm 65-ft-head pump, close coupled to 7.5-hp 1750-rpm 3-phase 60-cycle 440-v splashproof induction motor

Turbine-oil purification system ..... Bowser, Inc

FEEDWATER EQUIPMENT:

Condensate pumps, 2 ..... C H Wheeler Manufacturing Co
600-gpm 225-ft dynamic head, horizontal

Condensate-pump drives, 2 ..... General Electric Co
60-hp 1200-rpm 3-ph 60-cycle 440-v splashproof induction motors

Boiler feed pumps, 3 ..... Byron Jackson Co
500-gpm 1600-psi 12-stage double-barrel volute design

Boiler-feed-pump drives, 3 ..... General Electric Co
600-hp 3600-rpm 3-ph 60-cycle 2300-v splashproof induction motors

Fifth-stage feedwater heater, 1 ..... Griscom-Russell Co
Integral desuperheating and subcooling zones, closed type, vertical, U-tube, 2715-sq-ft effective heating surface, raises 374,940 lb per hr water from 347.4 to 413.9 F, 400-psig shell pressure, 1800-psig tube pressure

Eighth-stage feedwater heater, 1 ..... Griscom-Russell Co
Integral desuperheating and subcooling zones, closed type, vertical, U-tube, 2520-sq-ft effective heating surface, raises 374,940-lb-per-hr water from 272.3 to 347.4 F, 190 psig shell pressure, 1800-psig tube pressure.

Thirteenth-stage feedwater heater, 1 ..... Griscom-Russell Co
Integral subcooling zone, closed, vertical, U-tube, 1650-sq-ft effective surface, raises 374,940-lb-per-hr water from 231.3 to 272.3 F, 60-psig shell press., 1800-psig tube press.

Thirteenth-stage heater drain pumps, 2 ..... Allis-Chalmers Mfg Co
125-gpm 91-ft head driven by 5-hp 3500-rpm 3-ph 60-cycle 440-v splashproof motors

Nineteenth-stage feedwater heater, 1 ..... Griscom-Russell Co
Vertical, closed type, U-tube, 1020-sq-ft effective surface, raises 264,350 lb per hr water from 104.2 to 154.7 F, 60-psig to 30-in. Hg shell press., 110-psig tube press.

Nineteenth-stage heater drain pump, 1 ..... Allis-Chalmers Mfg Co
40-gpm 127-ft head, close coupled to 5-hp 3500-rpm 3-ph 60-cycle 440-v motor

Deaerating heater, 1 ..... Cochrane Corp
Horizontal tray type, 450,000 lb per hr water flow, 10-min storage capacity, 30-psig shell press., U-tube vent condenser

Evaporator, 1 ..... Griscom-Russell Co
Horizontal, bent tube, 9000 lb per hr vapor at 24.57 psig when supplied with 10,500-lb-per-hr steam at 54.47 psia, 1204.8 Btu per lb, 50-psig shell press., 100-psig tube press., 327-sq-ft surface, 54-sq-ft disengaging surface

Feedwater regulator, 3-element control ..... Republic Flow Meters Co

Water softener, double unit sodium zeolite ..... Permutit Co

Makeup deaerator, 1 ..... Cochrane Corp
Vertical tray type, 85-sq-ft tray area, 9000 lb per hr, 30-psig shell press., U-type vent condenser

PIPING:

Piping fabricator and erector ..... National Valve & Mfg Co
Lunkenheimer Co
Reading, Pratt & Cady
Grinnell Co

High and low-pressure valves ..... J E Lonergan Co
Manning, Maxwell & Moore, Inc
Wm Powell Co
Walworth Co
Hancock Valve Co
Chapman Valve Mfg Co

Reverse-current valves ..... Atwood & Morrill Co

Control valves ..... Fisher Governor Co
Leslie Co

Air-check valves ..... Pennsylvania Pump & Compressor Co

Miscellaneous piping equipment ..... Andale Manufacturing Co
Elliott Co
Schutte-Koerting Co
National Valve & Mfg Co
U. S. Pipe & Foundry

FUEL-OIL EQUIPMENT:

Fuel-oil storage tank, 1, 55,000 bbl ..... Chicago Bridge & Iron Co

Fuel-oil transfer pump, 1 ..... Kinney Manufacturing Co
1000 gpm, 150-psig discharge, 23-in. vacuum, speed reducer

Fuel-oil transfer-pump drive, 1 ..... General Electric Co
150-hp 1770-rpm 3-ph 60-cycle 440-v open squirrel-cage motor

Fuel-oil booster pumps, 2 ..... Kinney Manufacturing Co
80 gpm, 65 psig discharge, flooded suction

Fuel-oil booster-pump drives, 2 ..... General Electric Co
2.5-hp 230-rpm 3-ph 60-cycle 440-v splashproof gear motors

Light-oil storage tank, 16,000 gal ..... Johnstone Bros Fuel Co

Light-oil pressure pump, 1-15 gpm ..... DeLaval Steam Turbine Co

Light-oil pressure pump drive, 1 ..... General Electric Co
5-hp 1750-rpm 3-ph 60-cycle 440-v squirrel-cage splashproof motor

Fuel-oil heaters, 20 ..... Griscom-Russell Co
Fin-type sections, 5 parallel streams of 4 sections (one stream spare) to heat 70-gpm bunker-C oil from 100 to 250 F

High-pressure fuel-oil pumps, 2 ..... DeLaval Steam Turbine Co
75-gpm 1100-psig discharge, bunker-C oil

High-press. fuel-oil pump drives, 2 ..... Allis-Chalmers Mfg Co
75-hp 1750-rpm 3-phase 60-cycle 440-v splashproof motors

ELECTRICAL EQUIPMENT:

Main power transformers, 4 ..... General Electric Co
Single phase 14,667/18,333 kva self-cooled/forced-air-cooled 115 kv ground wye—13.2 kv delta, 60-cycle oil-immersed

Station service transformers, 2400-v, 2 ..... General Electric Co
3-ph 3750-kva self-cooled 13,200/2400-v 60 cycle delta-delta pyranol filled

Station service transformers, 480-v, 2 ..... General Electric Co
3-ph 1000-kva self-cooled 2400/480-v 60 cycle delta-delta pyranol filled

Oil circuit breakers, 115-kv, 4 ..... General Electric Co
800-amp continuous and 1500-mva interrupting capacity, air-operated mechanism, 5-cycle tripping, 20-cycle reclosing

Circuit breaker, 13.8-kv, 1 ..... General Electric Co
Air blast, 3000 amp continuous and 1000-mva interrupting cap

Generator excitation switchgear ..... General Electric Co

Generator protection equipment ..... General Electric Co

Duplex control switchboard ..... General Electric Co

Station-service switchgear, 2400 and 480 v ..... General Electric Co

Generator bus duct and neutral cubicle ..... General Electric Co

Lighting transformers and panels ..... Westinghouse Electric Corp

Meters and instruments ..... General Electric Co

Spare exciter m-g set ..... General Electric Co

Storage battery, 125-v ..... The Electric Storage Battery Co

Battery charging panel ..... General Electric Co

Battery-charging m-g sets ..... Electric Products Co

Intercommunication phone system ..... Kellogg Switchboard & Supply Co

MISCELLANEOUS EQUIPMENT:

Plant air compressor, 1 ..... Pennsylvania Pump & Compressor Co
Single-stage double-acting horizontal, 215-cfm 100-psig

Plant air-compressor drive, 1 ..... General Electric Co
50-hp 1200-rpm 3-phase 60-cycle 440-v splashproof motor

Soot-blower air compressors, 2 ..... Pennsylvania Pump & Compressor Co
Two-stage tandem double-acting, horizontal, 184 cfm, 350 psig after-coolers

Soot blower air-compressor drives, 2 ..... General Electric Co
60 hp, 1200 rpm, 3 phase, 60 cycle, 440 v, splashproof motors

Air receiver, 576-cu-ft ..... Combustion Engineering-Superheater, Inc

Miscellaneous tanks ..... Coastal Steel Construction Co

Chemical feed pumps, 2 ..... Milton Roy Co
One duplex, 78 gph per cylinder adjustable, 2000 psig discharge; one simplex, 2 gph adjustable, 20-psig discharge pressure

Air compressors, 2 ..... Pennsylvania Pump & Compressor Co
For combustion control, single stage, double acting, horizontal, 79 cfm, 100 psig

Combustion-control air-comp drives, 2 ..... General Electric Co
20-hp 1800-rpm 3-ph 60-cycle 440-v splashproof motors

Cold-well pumps, 2 ..... Allis-Chalmers Manufacturing Co
350-gpm 173-ft head, close coupled to 20-hp 3550-rpm 440-v motor

Turbine-room crane ..... Manning, Maxwell & Moore, Inc

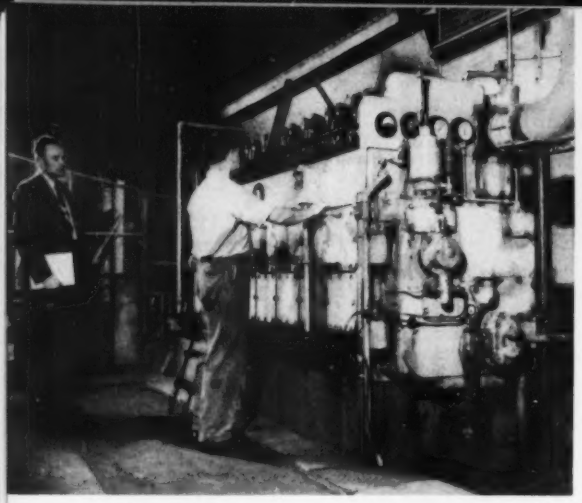
Screen wash pump, 1, 330 gpm ..... Allis-Chalmers Manufacturing Co

Sump pumps, 3, 20 gpm ..... Southern Pump & Supply Co

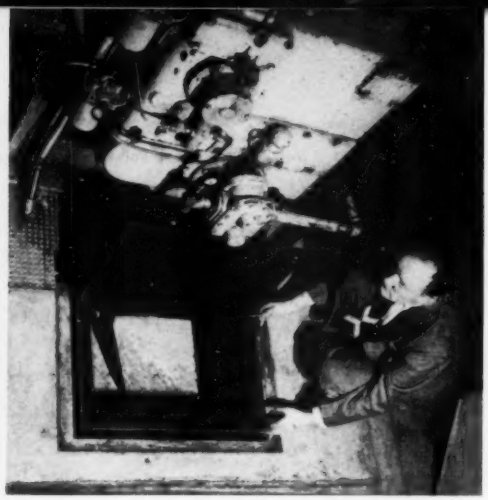
Gantry crane, 10-ton ..... Industrial Equipment Co

Passenger and freight elevator ..... Otis Elevator Co

ENGINEERS AND CONSTRUCTORS ..... The Kuljian Corporation



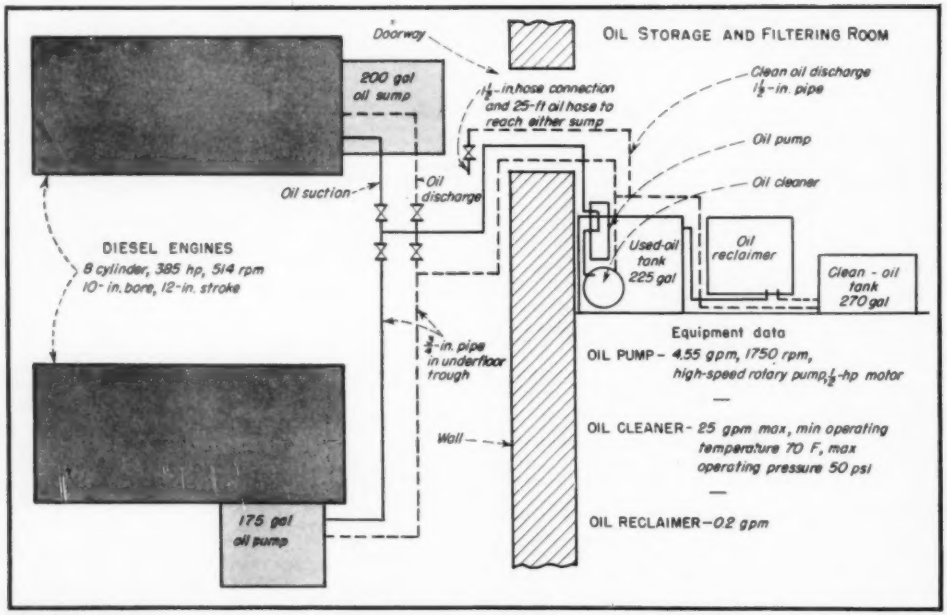
385-hp Diesel above is one of the prime movers for driving plant's line shaft. Shaft, in turn, powers the air compressors



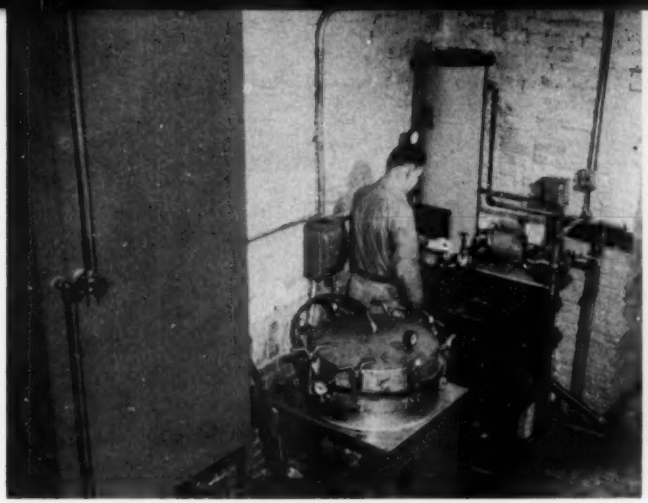
First Job called for enlarging the lube-oil sump. Original lube pit had top capacity of 65 gal; now it will hold 200

Diesel Lube Filters Save Man-hours

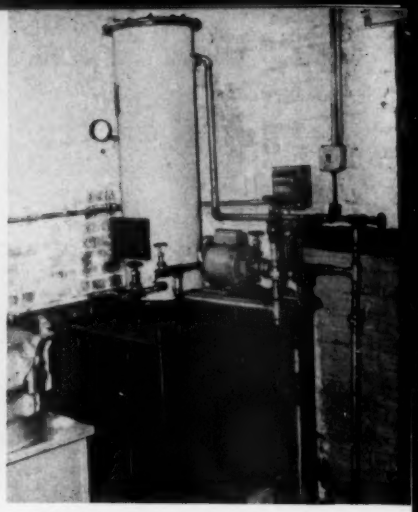
. . . and dollars, too. That's what Jay Kapla of Apex Oxygen Corp, New York, found when he combined bypass and batch purification methods


Doorway
OIL STORAGE AND FILTERING ROOM
200 gal oil sump
1½-in. hose connection and 25-ft oil hose to reach either sump
Clean oil discharge 1½-in. pipe
Oil pump
Oil cleaner
Oil suction
Oil discharge
DIESEL ENGINES
8 cylinder, 385 hp, 514 rpm
10-in. bore, 12-in. stroke
Used-oil tank 225 gal
Oil reclaimer
Clean - oil tank 270 gal
¾-in. pipe in underfloor trough
Wall
175 gal oil pump
Equipment data
OIL PUMP – 4.55 gpm, 1750 rpm, high-speed rotary pump, ½-hp motor
OIL CLEANER – 25 gpm max, min operating temperature 70 F, max operating pressure 50 psi
OIL RECLAIMER – 0.2 gpm

Oil-Purification Setup called for pipework and valves between diesels' oil sump and filtration equipment. Where possible piping is kept in under-floor trough. Kapla keeps 5 batches of oil on hand; 2 in engine, 1 in purifier, 2 in storage drums



Shift Operator, with back to fuller's-ea th purifier, opens drain from cellulose filter into "dirty" oil tank. Clean oil-storage tank, to the *left*, will hold 270 gallons of oil



Cellulose Filter in upright tank will separate out particles down to 2 microns

► I LIVED THROUGH many an anxious and backbreaking moment the first few months after our diesel plant was put in operation. First off, this matter of an undersized lube-oil sump — at least I consider it undersized — left too little oil in the sump while the engines were running. Each diesel sump had about 65-gal. capacity. Quantity of oil in each engine at any one time varied, creeping at times to 50 gal. And I consider a 15-gal reserve a little too tight. An oil leak might mean pulling air rather than oil into the suction line before an operator or the oil-pressure trips could shut unit down.

We licked that problem by adding an extra section to the sump of each engine. This change brought sump capacity to 175 gal for one machine. And the second engine's pit was large enough to take a 200-gal sump . . . so that's what we installed.

Oil Purifying. After the sump-size problem was licked we looked seriously into improving our lube-purifying methods. Our original setup had but one fuller's-earth oil reclaimer. And after about ten hours' operation the reclaimer would start clogging up. Incidentally, this crude purifying method called for emptying the engine sump into drums, then strong-arming the drums up a few steps into the oil storage and purifying room alongside the machine floor. Of course, after purification the oil was put back into drums, lugged down the few steps, poured back into the engines' sumps.

We've gone a long way since then. My first step was to install a second purifier (shown as an oil cleaner, sketch to left). This unit is made up of a 2-ply filter cartridge of bleached cellulose crowned with a single layer of muslin. A small motor-operated gear pump, rated at about 5 gpm, now pulls the oil from either engine (bypass principle) and sends it through this new cellulose filter. This setup called for pipelines and valves between engine sumps and oil-purifying equipment. Oil in each engine is now sent through the cellulose purifier on alternate days.

Let's halt a moment and define a filter. It's simply a mechanical device for separating solids from liquids. Under some conditions a filter may separate two fluids. But in the final analysis true separation by filtration depends on difference in size.

Solid impurities usually consist of dust and dirt from amosphere and carbon particles from burned fuel and lube oil. And if these impurities are allowed to collect the oil becomes unfit for use. This is not because oil wears out or loses its lubricating qualities. But it actually is more likely to clog oil ducts, passages, holes, etc. On top of that, many solid impurities are abrasive and hence cause excessive wear. So with that bit of fundamental theory under our belt let's consider the next step in improving oil-purifying setup.

Batch Purifications. Of course, we still keep the fuller's earth for batch purification. And that comes into the picture when we want to drain the sump and purify the whole batch of oil. To do it we simply close the valve in clean-oil discharge line and have the 5-gpm gear pump pull the oil from the sump, through the cellulose oil cleaner and into the cube-shaped "dirty-oil" storage tank below the oil cleaner and pump.

From here the oil is sent through the fuller's-earth purifier and then to the clean-oil storage tank. This oil is then ready to replace the batch at work in either diesel. Batch replacement usually takes place on alternate Mondays. We handle this swap by draining the "2-week old" oil from the engine sump late Friday afternoon. We pump it through the cellulose purifier and into the cube-shaped "dirty-oil" tank beneath the gear pump. At the same time we have the clean charge ready in the storage tank.

Comes Monday morning, two of the boys go to work cleaning out the engines' cam case and sump pit. Then the purified oil from the week before—setting in the clean-oil storage tanks—is allowed to run into the engines' sumps by gravity. Combined cleaning and oil replacement takes one hour.

Of course, oil pulled out on Friday is sent through the fuller's earth during the week, then stored for the coming Monday morning. And while this is taking place the gear pump and cellulose purifier are continually at work on the charge in the engines' sumps.

Oil Testing. Nowadays there is little need for lube-oil analysis by the small-plant operator. Most major oil companies have established service procedures that take this chore out of the individual plant and into the oil company's laboratory where it belongs. For instance, in my case, the oil supplier's field engineer drops in every three months and takes an oil sample. He then sends me a complete analysis based on his laboratory's report.

How long does our oil last? Well, it's a little early to make positive statements. But I do have oil in use after 1800 hours' operation.

Truck Delivery from local coalyard eliminates coal-thawing problem during freezing weather. A little costly, but worth it

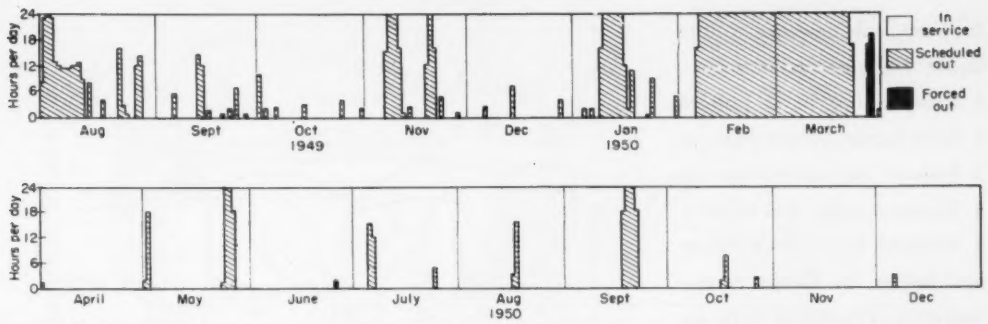
Railroad Cars used during rest of year. But if transportation troubles crop up, plant falls back on 3000-ton stockpile

Coal Stockpiling calls for smart jockeying of bulldozer. Aim is to keep pile shallow, well packed. Mike Yunich is shown directing piling operation. Plant uses 2 to 3 RR cars of coal every winter day. Pile will last 60 days in emergency

Thermocouple Check is made every week throughout coal pile. Temperature readings are recorded and any hot spot noted

Tips on Handling Coal in Small Plant

Mike Yunich, chief engineer at the Cleveland Graphite Bronze Co, has a 3-way coal setup to cope with all emergencies. He neatly avoids coal thawing by using trucked coal in winter. And stockpile serves if regular supply fails



UP TO AUG 31, 1950 scheduled hours out totaled 1921. Of these, 564 were for inspections, no maintenance; 1057 for inspection and overhaul; 300 for maintenance. First two outage types could have been omitted without affecting operation

Belle Isle Gas Turbine Sets Records

J W Blake, Oklahoma Gas and Electric Co, reports on gas-turbine performance at their Belle Isle Station (formerly Huey). Continued high availability and good operating efficiency prove soundness of application, ruggedness of gas turbine design

PLANT-PERFORMANCE DATA

Period covered—July 29, 1949 to December 27, 1950 — Total operating hours—10,313

Equipment rating: Steam turbines, 1—30,000 kw; 1—20,000 kw. Gas turbine, 1— 3,500 kw

Average load on station, kw	40,915
Average load on gas turbine, kw	4,231
Unit capacity factor, station, %	86.5
Unit capacity factor, gas turbine, %	120.9
Average load pickup through gas-turbine exhaust, kw	2,400
Average load credited to gas-turbine fuel, kw	6,631
Average fuel input to gas turbine, million Btu per hr	86.0
Average heat pickup from gas-turbine exhaust by feedwater, 10^6 Btu per hr.	39.2
Average heat rate from gas-turbine exhaust recovery, Btu per kwhr (hhv)	16,380
Corresponding thermal efficiency, %	20.2
Average heat rate from gas-turbine fuel, Btu per kwhr (hhv)	12,966
Corresponding thermal efficiency	26.3
Average heat rate regenerative feed-heating part of station, Btu per kwhr	15,579
Corresponding thermal efficiency, %	21.9
Average heat rate, total station, Btu per kwhr	15,229
Corresponding thermal efficiency, %	22.4
Gas turbine:	
Average compressor air-inlet temperature, F	62.1
Average turbine-inlet temperature, F	1,342
Average exhaust temperature, F	799
Maximum load, kw (56-F compressor air-inlet temp)	5,000
Gross generation, gas-turbine generator, kwhr	43,631,000
Gross generation, gas-steam turbine combination, kwhr	68,382,000
Steam turbines:	
Average steam pressure, psig	402
Average steam temperature, F	728
Average condenser backpressure, in. Hg abs	2.06
Unit fuel cost, gas-steam turbine combination, mills per kwhr	1.170
Unit fuel cost, total station output, mills per kwhr	1.369

► DETAILS OF THIS GAS-TURBINE installation were first given in POWER, Sept 1948, pp 518-525, and a preliminary operating report appeared in Feb 1950, pp 96-101. Up to Aug 31, 1950 the chart above shows the over-all unit availability to have been 79.5%. When eliminating the scheduled inspections and overhauls that were purely precautionary and had no effect on operation experience, the availability rises to 97.5%. Since Apr 1, 1950 the chart shows an availability well up, about 96%.

Forced outages occurred twice keeping the unit off the line for 34 hr. Failure of the main gear-driven centrifugal lube-oil pump caused the first forced outage. A bad impeller damaged the pump but no other equipment, since the auxiliary pump cut in automatically. Combustor flame-detector failure caused the second forced outage. Installed on two combustors, both detectors burned open, automatically shutting down the unit.

Production costs allocated to the gas turbine-steam turbine combination line up as follows:

Fuel	$58,000
Maintenance	11,982
Operating labor and miscell	8,400
Total	$78,382

These costs correspond to a generation of 49,600,000 kwhr, making the unit cost 1.58 mills per kwhr. Complete station cost averaged out at 1.886 mills per kwhr. Maintenance on this installation should not exceed $1 per kw per year of combination capability. For more details see ASME paper No. 50-A-78 by J W Blake presented at winter meeting.

To burn calcium-base sulfite liquor without auxiliary fuel:

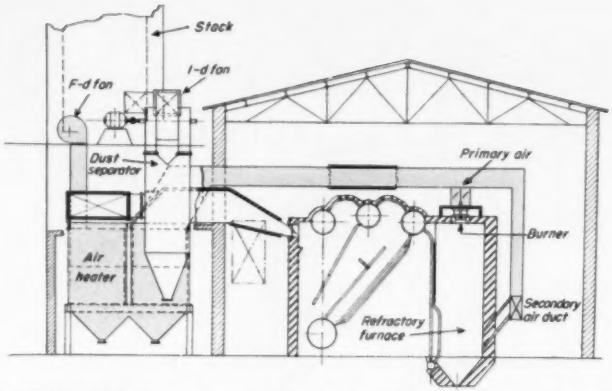
1 Spray liquor in U pattern

2 Keep furnace temperature up

3 Preheat the combustion air

4 Steam-atomize the liquor

5 Use high liquor temperature and follow the design recommendations outlined here for existing and new boiler plants



1 EXISTING BOILER can be converted to burn calcium-sulfite liquor by installing new furnace, air heater and dust collectors. Favorable efficiency is obtained

How to Burn Calcium-Base Sulfite

By C E ROGERS *Research and Development Dept, Babcock & Wilcox Co*
and
R S JOLLEY, *Combustion Engineer, Consolidated Water Power & Paper Co*

► EFFLUENT LIQUOR from calcium-sulfite mill digesters pollutes streams when discharged to them. Sulfite Pulp Manufacturers League, of the Wisconsin area, has studied methods for economically disposing of liquor without pollution. Concentrating liquor to reduce quantity to be processed for preparing road binder, yeast, vanillin and alcohol is one approach to problem. But derivative market is limited. Another approach is burning excess liquor for steam generation.

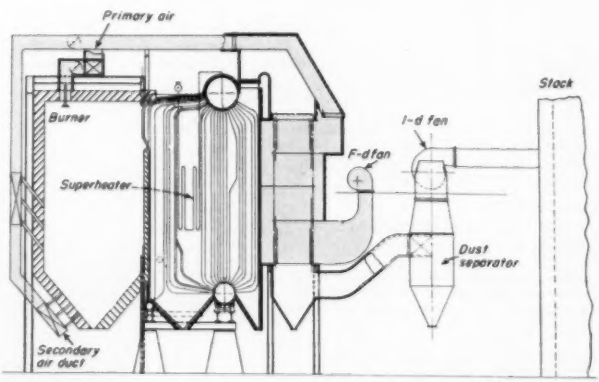
Consolidated Water Power and Paper Co., Wisconsin Rapids, tried burning sulfite liquor at the Interlake Div., Appleton Wis., and consulted Babcock & Wilcox Co for their opinions. B&W's experience showed that liquor could be burned without auxiliary fuel. To reaffirm these beliefs, an experimental unit, Fig. 3, was set up and tests conducted. Before going into details of these tests, let's look over the major results and what they mean to men in pulp-mill power plants where calcium-base sulfite liquor is available.

Liquor Firing. Sulfite liquor can be burned without auxiliary fuel. Spraying liquor in a U-shaped pattern to reverse flow of burning liquor through incoming liquor spray is desirable. This dries liquor in flight. Since this liquor has a relatively high moisture content a properly designed refractory furnace is needed to maintain high temperatures for complete combustion. Faster drying and better combustion are obtained by preheating combustion air. An air heater using flue gas is suitable for this work. Fig. 4 illustrates a typical unit.

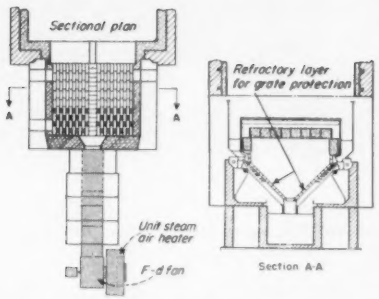
Good suspension burning is obtained with steam-atomizing burners when liquor pressures vary between 65 and 90 psig, and burner steam pressure is 85 to 110 psig. High liquor temperature, in 200-F range, is needed for good firing. Liquor should be heated in manner that doesn't cause excessive dilution.

Boiler Arrangement. Our tests show that certain arrangements are more desirable than others when calcium-base sulfite liquor is to be burned without auxiliary fuel. Fig. 1 shows an existing boiler converted for liquor burning by installation of a new furnace, air heater and dust collectors. Expected performance of this unit is summarized in Table I. Efficiency would be about 69%.

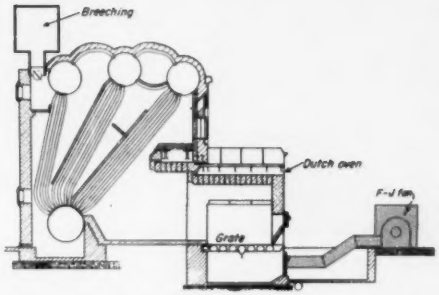
Suggested arrangement for new boilers is shown in Fig. 4 with performance summarized in Table II. An efficiency of



4 NEW BOILER for burning calcium-base sulfite liquor works well when arranged as shown. Designed for use with a turbine-generator, unit has a good efficiency



2 REFRACTORY LAYER over stoker grates protected them in early test runs. Almost all refractory later removed



3 EXPERIMENTAL BOILER used in calcium-base sulfite liquor firing tests was 50-year old Stirling stoker-fired unit

Liquor Without Auxiliary Fuel

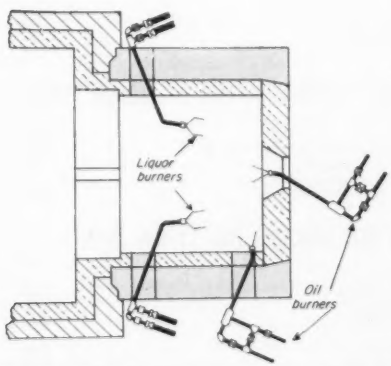
better than 72% should be obtained. Either arrangement, depending on calcium-sulfite mill requirements, satisfactorily disposes of excess liquor.

Test Details. Boiler selected for test was an existing Stirling unit with 2900 sq ft of heating surface without superheater, economizer, air heater or other heat-recovery devices, Fig. 3. With refractory dutch oven over Detroit V-type stoker, unit generates about 10,000 lb per hr at 125 psi.

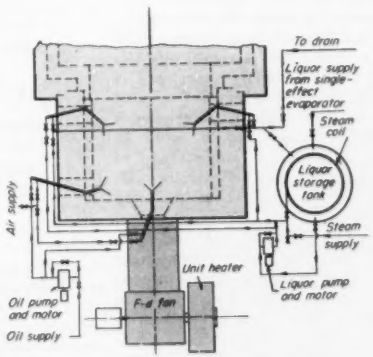
To adapt unit to liquor firing a layer of firebricks was placed over stoker grates. Openings were left for air admission, Fig. 2. Also, a forced-draft fan was installed to supply combustion air. Sidewall openings were cut for insertion of portable liquor and oil burners, Fig. 5. Fig. 6 shows piping hookup used for liquor storage tank, heater and pumps. Feed to tank was from small single-effect Rosenblad evaporator used for preparing derivatives.

A series of test runs was made and firing conditions studied during each run. Before each run, furnace and boiler were preheated with oil. When normal furnace temperature was reached, liquor firing began and oil was gradually cut out. Build-up of ash, improper liquor atomization, insufficient heating and agitation of liquor and plugging of sprayer plates with wood chips were some of the problems encountered during these runs. They were cured by using the firing procedure outlined at the beginning of this article, changing burner type and heating liquor to higher temperature before firing.

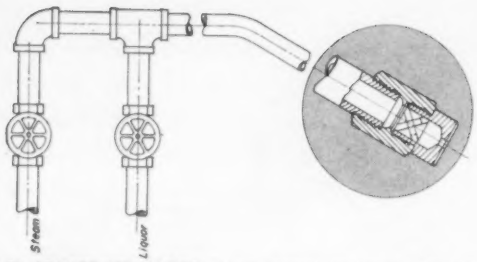
Final setup of firing equipment worked out like this. Two opposed Y-jet steam-atomizing burners, Fig. 8, equipped with 45-deg angle sprayer plates fire from rear toward furnace front wall. Larger-capacity liquor pump was installed along with a direct-steam heater. This heater is a ¾-in. pipe with two rows of ⅛-in. holes drilled on 1-in. centers. Holes discharge at 45-deg angle to each other. Heating coil, near



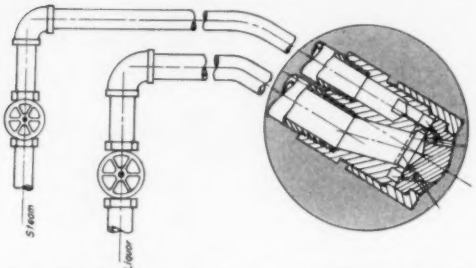
5 OIL AND LIQUOR BURNERS, of steam-atomizing type, were located to produce maximum turbulence, drying in furnace



6 PIPING ARRANGEMENT for liquor and oil burners used in the test. Heater should not over-dilute liquor in storage



7 **SQUARE JET NOZZLE** originally used for liquor firing did not work too well and was replaced with burner in Fig. 8



8 **Y-JET NOZZLE**, steam atomizing, was fitted to extended burner pipe for liquor burning. These burners work well

storage-tank bottom, gives good stirring action to liquor. Dilution is low; in one instance 790 gal of liquor was raised from 119 to 137 F in 20 min, diluting liquor from 61.7 to 60.5% solids.

Duration of final test run was 20 hr and unit operated continuously without aid of supplementary fuel. Before this run all refractory was removed from stoker grates except an 18-in.-wide portion at top of each inclined side. Incoming liquor spray from burners passed through the reversed flow of the hot gases. During 20-hr run, average liquor firing rate by the two nozzles was 5.2 gpm. Liquor contained 59.5% solids and was preheated to 194 F. Natural-draft stack induced combustion air at room temperature into primary furnace. Boiler, which was converted from coal firing, operated at 85 to 100% of rating. Table III summarizes typical run results and Table IV gives computed data representative of calcium-base sulfite liquor firing without auxiliary fuel. Properties of ash obtained during one run were analyzed. They are given in Table V.

Test Results. Review of tabular data given here shows that experimental boiler operated at 53% efficiency during tests. But this efficiency value should not be considered too critically for several reasons. Stirling boiler used in the tests is more than 50 years old, and the tests were made to determine if calcium-base sulfite liquor could be burned satisfactorily without help of supplementary fuel. Maximum efficiency was not a consideration during these tests.

Any steam-generating unit will operate at lower efficiency when firing liquor. High moisture and hydrogen content of liquor increase combustion heat losses. With a unit equipped with suitable heat-recovery devices, efficiencies of 69 to 72% should be obtained. Liquor must be concentrated before being fired.

I: EXPECTED PERFORMANCE OF EXISTING BOILER CONVERTED TO LIQUOR FIRING

Calcium-base sulfite liquor: 65% solids; hv 5020 Btu per lb as fired	
Liquor burned, lb per hr	5650
Steam generated, lb per hr	19,640
Steam pressure at boiler outlet, psi	110
Steam temperature at boiler outlet, F	Saturated
Feedwater temperature, F	210
Air temperature leaving air heater, F	615
Gas temperature leaving air heater, F	465
Boiler efficiency, %	69

II: EXPECTED PERFORMANCE OF NEW BOILER DESIGNED FOR LIQUOR FIRING

Calcium-base sulfite liquor: 65% solids; hv 5020 Btu per lb as fired	
Liquor burned, lb per hr	11,300
Steam generated, lb per hr	34,800
Steam pressure at superheater outlet, psi	420
Steam temperature at superheater outlet, F	740
Feedwater temperature, F	220
Air temperature leaving air heater, F	454
Gas temperature leaving air heater, F	388
Boiler efficiency, %	72.4

III: TEST DATA FOR TYPICAL RUN OF EXPERIMENTAL BOILER

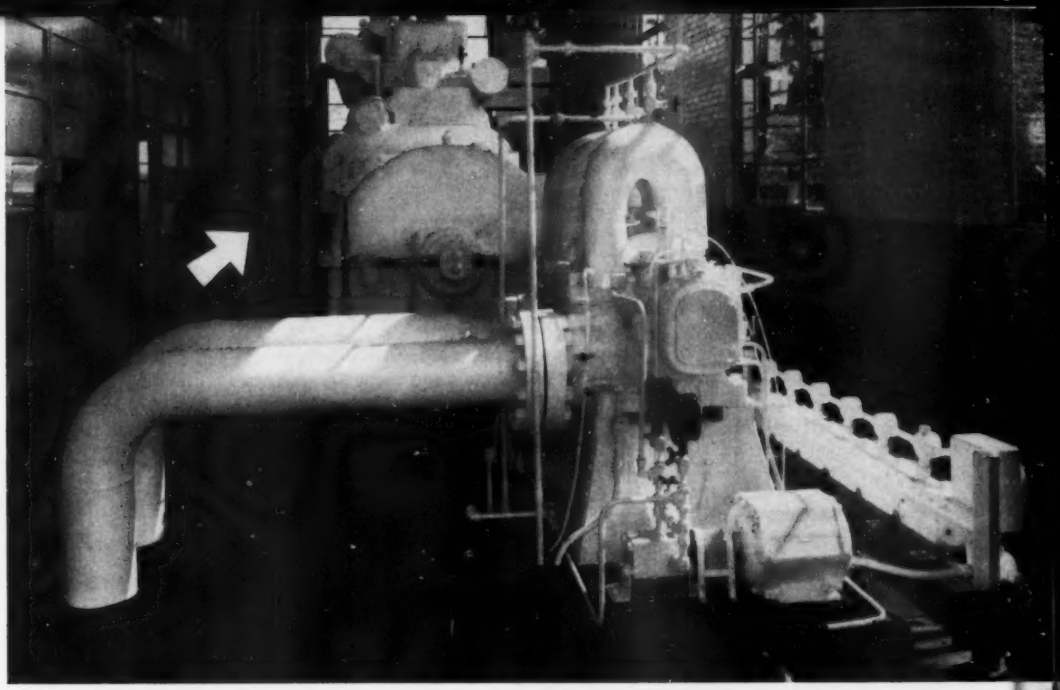
Liquor analysis:			
Moisture, %	38.3	Sulfur (total), %	3.4
Carbon, %	27.8	Ash, %	9.2
Hydrogen, %	2.6	Oxygen and nitrogen, %	18.7
Heating value, Btu per lb as fired			4710
Run duration, hours firing liquor alone			20
Liquor firing rate, gpm			5.2
Liquor temperature, F			194
Steam generation, lb per hr			8830
Steam pressure, psig			125
Steam temperature, F			353 (Sat.)
Feedwater temperature, F			210
Combustion-air temperature, F			80
Excess air, %			48

IV: COMPUTED DATA REPRESENTATIVE OF LIQUOR FIRING

Liquor fired, lb per hr	3590
Liquor solids fired, lb per hr	2215
Equivalent steam generated from and at 212 F, lb per hr	9236
Equivalent lb steam per lb of liquor	2.57
Equivalent lb steam per lb of liquor solids	4.17
Equivalent lb steam per ton of bone-dry pulp	10,760

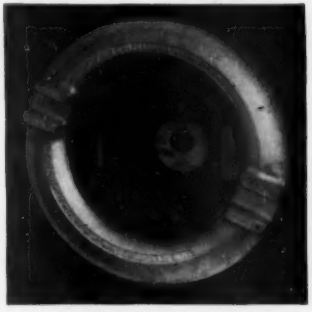
V: LIQUOR ASH ANALYSIS FOR TYPICAL RUN

Laboratory ash from liquor:	
Initial deformation, reducing, F	2710
Initial deformation, oxidizing, F	2600
Fluid temperature, reducing, F	2730
Fluid temperature, oxidizing, F	2620
Ash from secondary furnace:	
Initial deformation, reducing, F	2650
Initial deformation, oxidizing, F	2690
Fluid temperature, reducing, F	2670
Fluid temperature, oxidizing, F	2710
Carbon in ash, %	Nil



SIX-STAGE CENTRIFUGAL PUMP, diesel-engine driven, handles up to 23 products at once. Pump has double mechanical seals fitted with tubes that draw air from seal vicinity, discharge to combustible-gas analyzer and alarm system on the panel

Analyzers Guard Pumping Stations, Save Space



GAS-ANALYZER closeup shows how unit is mounted on pumping station's panel

► SHELL OIL CO's North Products Pipe Line, running from Wood River, Ill. to E. Chicago, Ind., has five diesel pumping stations where engines and pumps operate in the same rooms. Seventeen different products, from propane to aviation gasolines, are piped simultaneously through the 250-mi line. At times 23 different products have been piped. Line is 8 in., has 33,000 bbl-per-day capacity when handling multiple products.

Continuous air sampling and analyzing instruments detect combustible concentrations of vapors around seals on flammable-liquid pumps. Alarm flashes warning and station is completely shut down when gas leakage becomes excessive. During nearly two years of operation there have been about a dozen alarms in which stations were shut down when vapor leaked around pump seals.

Combustible-gas alarms are Mine Safety Appliance Co's. Housed in explosionproof case and fitted with flashback arresters, each analyzing apparatus is mounted on main instrument panel in pump room (*above*). Copper tubing, $\frac{3}{8}$ in., carries air samples from space around double mechanical seals of pump to analyzer. Turbo-compressor with explosionproof motor draws air samples to analyzer.

Samples pass over one of two heated sensitized platinum filaments that are part of a balanced electrical circuit in instrument. One filament is sealed in cell containing uncontaminated air and the other is exposed to air sample. Combustibles present in sample burn on contacting hot platinum wire. This unbalances bridge circuit in proportion to combustible concentration in sample, deflecting an indicating contact-making meter designed to energize alarm circuit when concentration exceeds a predetermined setting.

Analyzer is calibrated to energize alarm circuit when vapor concentration reaches 60% of lower explosive limits. Though station operator may not be present when system flashes alarm and shuts down engine, drop in inlet pressure at next station on line is noticed. Operator at trouble spot then checks and notifies maintenance crew if condition can't be corrected locally. Alarm system is checked monthly by holding gasoline-soaked rags near intakes.

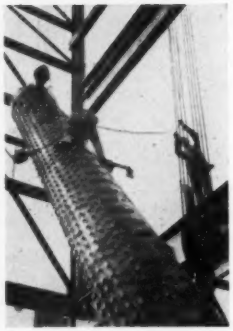
Installation of engines and pumps in same room saves considerable space, reduces construction costs, gives greater operating and maintenance convenience. Besides vapor analyzers, stations are safeguarded against high bearing temperatures, gland temperature, unduly low pressures on inlet side or high pressures on discharge side. If any of these occur, stations shut down.

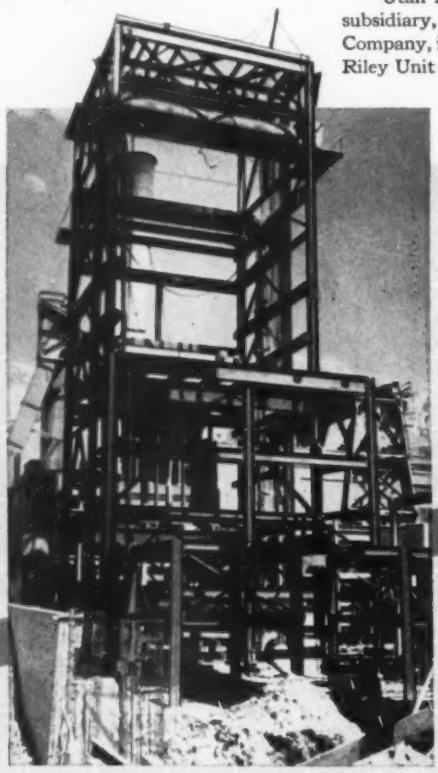
Pattern of Progress at Utah Power

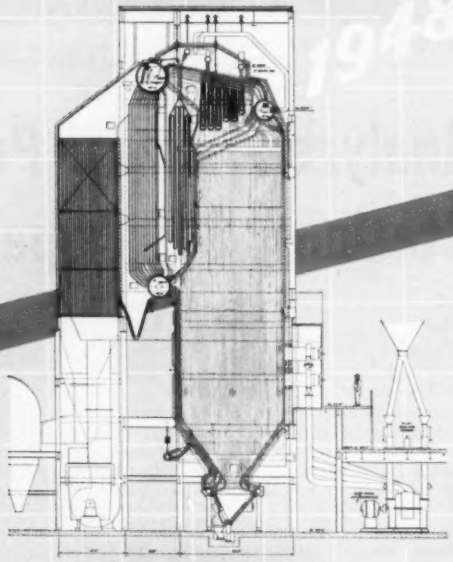
Utah Power and Light Company has instituted a program tremendously increasing its power producing capacity. While their Pattern of Progress includes expansion of many facilities other than their steam power plants, it is an all Riley performance insofar as new steam generating units are concerned.

Utah Power and Light Company installed its first Riley Unit at its Orem Station in 1948—a 450,000 lbs./hr. Riley Unit. Utah Power and Light Company is now installing a 620,000 lbs./hr. 1500 psig 955°F. Riley Unit at its New Jordan Station, and has ordered a 575,000 lbs./hr. 1700 psig 1000°F. reheat Riley Unit to be placed in operation in 1952.

Utah Power and Light Company's subsidiary, Western Colorado Power Company, is installing a 70,000 lbs./hr. Riley Unit at Montrose, Colorado.







450,000 LBS./HR.
1050 LBS.–955°F.

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston · New York · Philadelphia · Washington · Buffalo · Pittsburgh · Cleveland · Detroit · Chicago
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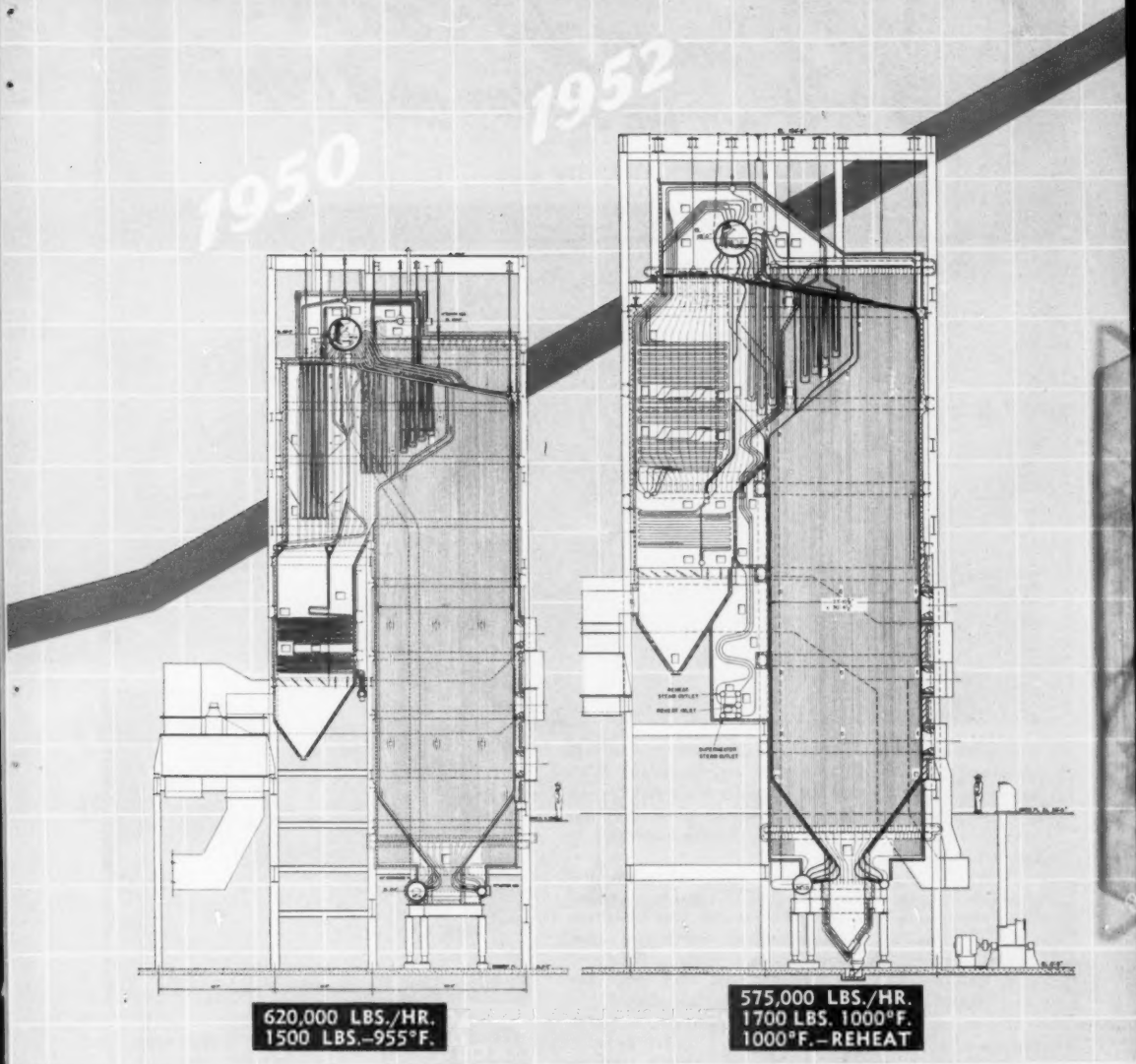


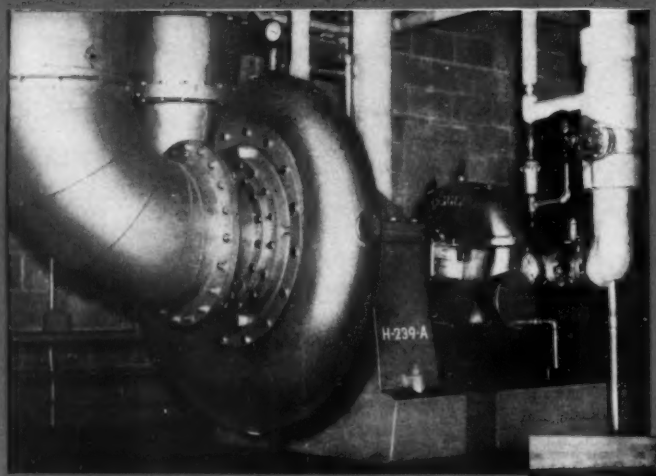
A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS · WATER-COOLED FURNACES · STEEL-CLAD INSULATED SETTINGS · AIR HEATERS

"always glad to see you... but we seldom need help!"



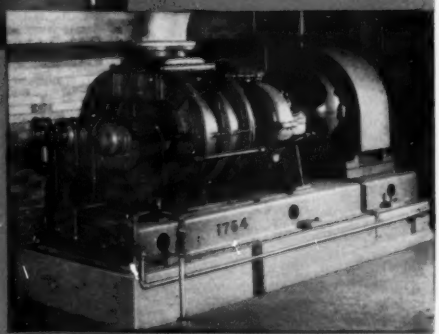
CENTRIFUGAL

Type OSB Centrifugal Blower used for processing in a large eastern plant. Capacity 12,000 cfm. Similar R-C Blowers are utilized in other plants of this company.

The works manager of a large plant made this friendly statement to a Roots-Connersville representative. What he really meant was that R-C Blowers and related equipment perform so satisfactorily and dependably that they seldom need anything more than routine inspection by his own men.

In large and small plants, in every industry, R-C products uniformly give this kind of reliable operation. They continue to deliver rated capacities, year after year, with a minimum of maintenance—whether a small Rotary Positive Blower of 5 cfm capacity or a Centrifugal unit moving up to 100,000 cfm. And remember, only Roots-Connersville gives you this dual-choice.

If you are planning a new plant, expansion, or replacements, R-C engineers will work with you to select the equipment best fitted to your needs. Almost a century of experience is at your service.



ROTARY

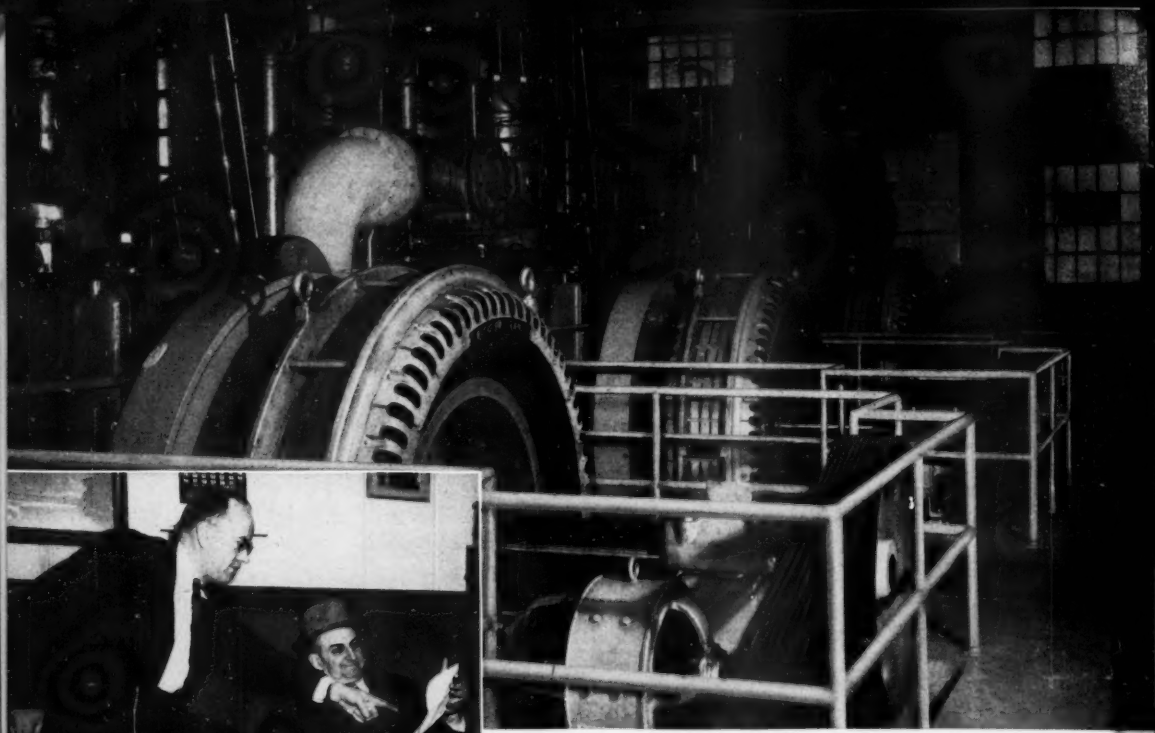
One of two Type RCDH Rotary Positive units in vacuum service in a power plant. Capacities 3,380 cfm. and 3,490 cfm., respectively.

ROOTS CONNERSVILLE BLOWER CORPORATION
510 Powell Avenue, Connersville, Indiana

ROOTS-CONNERSVILLE

BLOWER BUILDERS SINCE 1854

ONE OF THE DRESSER INDUSTRIES



Above—In 1946, STANDARD HD Diesel Oil was tested in a 1400-hp Diesel engine in the Trenton (Mo.) Utilities plant. Today, the success of that trial is reflected by the use of STANDARD HD in the plant's five Diesel engines (one not shown).

Left—W. E. Ralls, plant superintendent, (at the right) and T. N. Okerstrom, Standard Oil Lubrication Engineer, discuss the highly satisfactory report on a recent analysis of STANDARD HD Diesel Oil samples from the plant's engines.

One good job leads to another . . . and another . . . and another!

The experience of W. E. Ralls, Superintendent of the Trenton Municipal Utilities plant at Trenton, Missouri, proves once again that reduction of downtime and maintenance is the Diesel operator's way to judge lubricating oil.

After talking with a Standard Oil lubrication specialist about the advantages of STANDARD HD Diesel Oil, Mr. Ralls put the heavy-duty lubricant to a test in the plant's 1400-hp Diesel engine. STANDARD HD came off with flying colors! The clean and trouble-free operation of this unit sold the new lubricant right into the plant's three 650-hp Diesels. When a new 1600-hp engine was installed in 1948 that, too, was filled with STANDARD HD Diesel Oil.

Today, the success of STANDARD HD on one job after another in this plant is reflected in more reliable Diesel operation and lower maintenance costs.

Let a Standard Oil lubrication specialist help you find how STANDARD HD Diesel Oil can reduce maintenance and overhauls. You can reach him quickly and easily by phoning the nearest local Standard Oil (Indiana) office. Or, if you wish, write: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD HD
TRADE MARK
Diesel Oil

STANDARD OIL COMPANY (INDIANA)

STANDARD

What
NEW STANOIL'S
longer life means to you . . . . . .

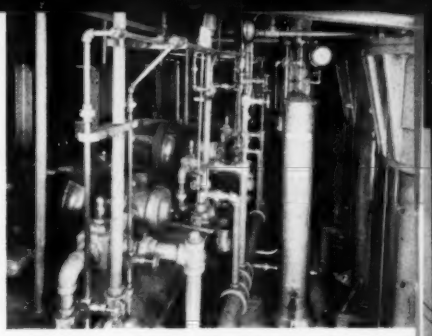
● For fourteen years STANOIL Industrial Oils have proved their ability to handle a wide variety of jobs in midwest plants. Now, these established products have been made better than ever! They offer new and important savings in an even wider variety of equipment because:

1. **Greater oxidation stability** in the New STANOILS enables them to stand up under high temperatures of operation, maintain low acidity for long periods of time, and reduce to the minimum deposits caused by oil oxidation.

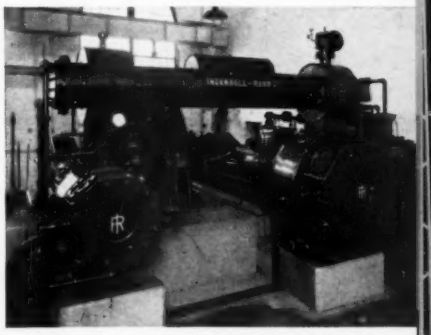
2. **High Viscosity Index and Low Pour Point** enable STANOILS to perform satisfactorily through a wide range of temperatures. They flow readily at low temperatures and do not thin out excessively at high temperatures.

3. **Greater protection against rust** has been provided by the addition of a corrosion inhibitor of an advanced type to all grades of New STANOIL. This inhibitor prevents corrosion trouble by "plating out" on surfaces that tend to rust. New STANOILS have practically put an end to rust and corrosion troubles.

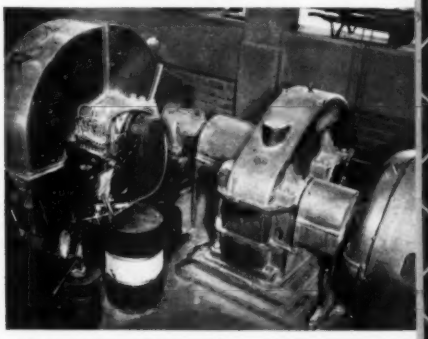
At the right are shown several types of equipment in which the New STANOILS can save you money and maintenance time. A Standard Oil Lubrication specialist will help you find still other applications where versatile STANOILS can replace many special-purpose oils. You can reach this man quickly and easily through your local Standard Oil Company (Indiana) office. Contact him today. Or, if you wish, write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.



In Hydraulic Systems. Because of the high viscosity index and low pour point of the New STANOILS, they provide smooth operation in hydraulic systems regardless of widely varying temperatures. They also eliminate foaming, which is frequently troublesome in hydraulic operation. Their high oxidation stability eliminates deposits that could cause valve sticking and wear.



In Compressors. Because of the oxidation stability and low carbon-forming characteristics of STANOILS, carbon deposits on valves are reduced in air-compressor operation. The New STANOILS separate readily from water—no troublesome emulsions in compressor crankcases.



In Reduction Gears. Because of STANOIL's resistance to acidity and to deposit formation, gear cases of reduction gears remain clean. The oil may be used for longer periods with no danger of excessive wear of gears and bearings.

STANDARD **STANDARD OIL COMPANY (INDIANA)**

Industrial Water Pollution...A new headache for power engineers? Not necessarily!

Modern instrumentation techniques offer a sane way out. By using instruments to measure and control the wastes he dumps into public waters, not only can the engineer safeguard the public, satisfy the government and protect himself, but also he can often improve his plant processes

NO LONGER CAN INDUSTRY JUST DUMP WASTES

14 EXPERTS LAY THE PROBLEM ON THE LINE*

HISTORY OF THE PROBLEM

W. B. HART, *Service Superintendent, The Atlantic Refining Co*

Even before 1900 fish-hatchery operators complained about water pollution. But it wasn't until the growth of large communities along rivers, lakes, etc, brought on the serious typhoid fever epidemics of 1902, 1903 and 1904 that stream pollution became important and laws were passed to require treatment of drinking water. In 1905 Pennsylvania created its State Department of Health. Other states followed. Sewage-treatment plants appeared slowly, then multiplied from 1930 to 1940.

World War I spurred industrial development along our waterways. Wastes of all kinds fed into our streams. More and more people began to demand legislation to keep streams clean. In 1924, the Federal

*Based on their opinions expressed at the symposium "Industrial Waste Disposal—a Problem for Instrumentation" sponsored by the Philadelphia Section of the Instrument Society of America, November 2, 1950.

Where POWER Fits In

Most industrial wastes come from production processes; yet it's the power engineer's responsibility to obtain water from public supplies and return it after production's through with it. Hence POWER presents this problem of industrial-water pollution to its 30,000 readers as the men best qualified to cope with it.

Water Pollution Act was passed, but this was limited and hard to enforce, so did little good.

In 1927, the American Petroleum Institute surveyed oil pollution in this country. Organization of the API Refinery Pollution Abatement Committee followed. It has been increasingly active ever since.

Meanwhile other types of pollution continued to increase and little was done. In Pennsylvania the Shapiro Bill for pollution abatement was introduced in 1932 but died in committee from industrial opposition. In 1937, Pennsylvania did enact a bill but appropriated no funds to make it work. Then came the war.

By 1945 with the war over, the pollution abatement problem was absolutely critical. Legislation was passed by 42 states with funds appropriated for administration.

Much remains to be done; the most forceful effect of these clean-up campaigns has been to solidify public opinion for water-pollution abatement and the recovery of our streams. They will not and cannot be returned to their original purity, but they will be available for all purposes, including recreation, which is increasingly important in these days of leisure.

METHODS AND PROCESSES

ROBERT T SHEEN, *Milton Roy Co*

To define the pollution of any plant, one must learn both quantity and quality of the water-borne waste. That is the function of instrumentation. Here are the main factors in a pollution load:

(1) Total solids (a) Dissolved organic and inorganic (b) Suspended organic and inorganic (2) Acidity and alkalinity (3) pH value (4) Color (5) Biochemical oxygen demand (of the stream) (6) Toxic materials, that is, hypochlorites, phenols, etc.

Once a survey is made of the above for both quantity and quality, an accurate evaluation is required to determine what the pollution load is and how to treat it.

Methods of Treatment. All methods of treatment are combinations of the following unit processes:

1. *Mechanical* (Screening, sedimentation, filtration, centrifuging, drying, incineration, floatation, evaporation and adsorption)
2. *Chemical* (Neutralization, oxidation, flocculation and precipitation and ion exchange)
3. *Biologicals* (Aerobic, anaerobic)

Screening and sedimentation are used for removal of large particles, *filtration* for small particles. *Centrifuging, drying and incineration* are commonly used for de-watering and disposal of sludges from sedimentation tanks. *Floatation* is employed where it's more economical to separate the liquid phase. *Evaporation* is expensive but sometimes pays on highly concentrated wastes. Activated charcoal is frequently used for *selective adsorption*—for example, phenol adsorption.

Highly acid or alkaline wastes require *neutralization*—lime is common for acid wastes, sulfuric acid for alkaline wastes. Often different wastes will neutralize each other. Chlorine is commonly used for *oxidation* to remove cyanides, many organics, etc. *Flocculation* is effected by chemicals that form flocs when added to water under proper conditions of acidity or alkalinity.

Biological methods need bacteria to oxidize and remove waste materials. *Aerobic* bacteria live in the presence of oxygen. Examples: trickling filters and activated sludge for removal of phenols and formaldehyde. *Anaerobic* bacteria live in the absence of air and are used in Imhoff or sludge-digestion tanks.

NEED FOR STANDARDS

L DREW BETZ, *Managing Director, W H & L D Betz*

One question frequently asked is, How much of what impurities can be safely discharged in a waste effluent? Yet state or public health officials have no standards available for limits of contaminating materials. Amount permissible usually depends on the receiving stream, size and downstream uses. But many technical associations have formed committees on waste disposal to study and set up standards for their industries.

What's Being Done. As Chairman of Subcommittee VII on Water Borne Industrial Wastes of Committee D19 on Industrial Water of the ASTM, I can describe our work with standards. We deal only with wastes being produced in industrial plants, not with standards of pollution load for the receiving stream.

Subcommittee VII is divided into four sections. *Section A* is listing the various industries and water-borne impurities normally discharged by each industry.

Section B, developing methods of analysis, is broken into twelve Task groups studying the following: suspended solids; turbidity and color; dissolved solids; acidity; alkalinity and pH; oxygen demand; taste and odor; chlorine demand; scum-forming constituents (oil, grease, etc); toxicity to aquatic life; phenol; cyanides and sulfur compounds.

Section C is studying standard methods for sampling, gaging and preservation of samples. An important problem here is maintaining the characteristics of a sample between the time it's procured and when it's tested in the laboratory.

Section D is developing standard methods of reporting analytical results of waste-water analysis.

PROBLEMS OF THREE INDUSTRIES

1—Chemical Wastes

BRUCE W DICKERSON, *Hercules Powder Co*

Wastes from the chemical industry are generally classified under the following five headings, plus sanitary sewage.

Inorganic Acids and Alkalis. In neutralizing inorganic acids, endpoint is usually pH 4.5 and sufficient ground limestone or burned or hydrated lime added to hold this value. A pH controller, with or without flow control, is used to regulate feed of alkali. Where burned lime is slaked on the job, close control of slaking temperature and water-lime ratio is essential.

When alkaline wastes are also discharged, blending the two may provide the answer. Then only a pH recorder is needed. But if either acid or alkali is insufficient, additional facilities for that feed are required with controls.

Soluble Inorganic Salts. These are treated two ways: (1) By thickening and sedimentation to drop out the soluble salts before effluent is discharged to stream or (2) where solubility is too high, waste is impounded and then discharged under control to stream

during high flows to get maximum dilution. For both, flow rate control only is needed.

Insoluble and Undissolved Solids. These can be removed by sedimentation alone or with a coagulant or by floatation. Plain sedimentation requires rate control of flow. Coagulation requires meters and controls for flow, pH and rate of coagulant feed.

Soluble Organic Substances. These comprise the largest scope of chemical plant wastes. Their treatments run all the way from chemical reaction under controlled conditions to biological oxidation, and may require measurement and control of temperature, pressure, flow and pH.

Tars and Tarry Substances. Incineration is usually employed here with proper control of air flow necessary to avoid smoke.

Sanitary Sewage. If too remote from a municipal sewage system, sewage may be disposed of in existing facilities at the plant for biological treatment of organic wastes. If none, an Imhoff tank followed only by chlorination and flow metering is necessary, provided there is good stream dilution. If volume is large or stream small, trickling filters or activated sludge processes are required.

2—Atomic Energy Wastes

ARTHUR E GORMAN, *Sanitary Engineer, Atomic Energy Commission*

Raw materials, finished products and wastes in the atomic-energy industry are very different from those of other industries. They require special handling. Cooling water to dissipate the enormous heat from nuclear fission is one such problem. This water must be extremely pure as dissolved or suspended components will be irradiated in passing through reactors and become radioactive. As cooling water must usually be returned to a nearby waterway, the degree of radioactivity in this water must be low enough so that, with the dilution that takes place, the water in the receiving stream will be safe for other uses. In treatment of the cooling water, only elements that will produce short-lived isotopes when irradiated are permitted to remain. As a further precaution, cooling-water effluent is held in large retention basins to permit decay of radioactivity to take place before release to nature.

3—Refinery Wastes

L C BURROUGHS, *Shell Oil Co*

There is no sharp line saying where refinery production ends and waste disposal starts. Even when crude oil is first received there is the problem of disposing of brine, emulsion and sediment from crude-oil storage tanks.

Studying the Problem. Three things must be learned: (1) Whether an alternate process, which would not produce harmful wastes, could be economically substituted for the original process. (2) Whether the process could be altered to reduce the volume of objectionable wastes. (3) Whether the waste produced may be treated to destroy its harmful effects.

Process Control. Here the problem is to keep all refinery operations at top efficiency with the result that not only are products of good quality produced but also harmful waste is kept to a minimum. Failure of a process control may mean not only the economic loss of considerable volume of oil but also harmful results to the effluent stream.

Treatment Control. Processes operated solely for treating harmful wastes often require special instrumentation. A typical example is removing ammonia and sulfide from certain refinery waste waters. Many crude oils contain objectionable sulfur compounds. In distilling these, ammonia gas is often used as a neutralizing agent to prevent corrosion. Ammonia combines with hydrogen sulfide in a dilute aqueous solution beyond the condensers. The resulting ammonium sulfides are harmful to aquatic life because of their oxygen-consuming and toxic characteristics. It's common practice to remove the ammonia and sulfide from solution by steam stripping. But as sulfide is stripped out, waste-water pH rises, and larger and larger amounts of steam are needed to complete the sulfide removal. But by using pH controllers to feed in sulfuric acid to keep the pH down, sulfide removal is accomplished with low steam consumption.

Sampling and Testing. Refiners would like to have a fairly simple and not too expensive device to sample waste water flowing from the refinery with samples taken in proportion to waste flow and a continuous record of the flow.

We're particularly interested in testing devices that give an accurate indication of harmful constituents in the waste-water effluent. Since refinery operations are many and varied, it is difficult to test all streams entering sewers at their points of origin. But if the combined waste-water stream could be tested at one or more central points, indication of objectionable amounts of specific impurities could be quickly traced to the source and corrected. Work has been done on an infrared method for determining oil content of waste water, but this has not always given reliable results. Equipment for continuous reading of phenol content, sulfide content and oxygen demand would be valuable.

CONSULTING ENGINEER'S VIEWPOINT

FRANCIS S FRIEL, *Albright & Friel Inc*

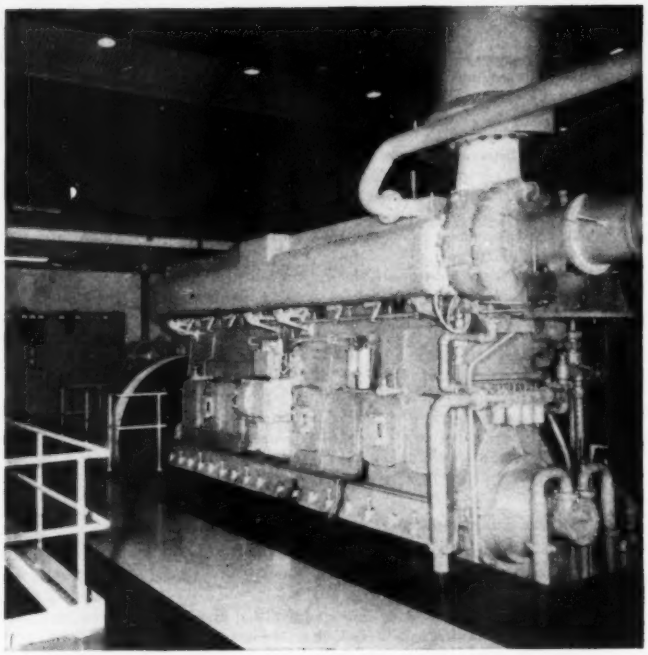
Instrumentation is vital to consulting engineers for accumulating data in making designs, for consideration in the design, for checking the design and for construction and operation of plants for sanitary purposes. The engineer who has to lay out waste-treatment facilities may temporarily find himself in a quandary. The variety of wastes may be great and little known of the quantity or composition of the wastes. It's best to start by obtaining flow records from each process and samples of the waste, *unless* the composite effluent of the plant is known to be such, at all times, that can be treated by conventional sewage treatment.

Discussions

CHARLES F HAUCK, *Hall Laboratories, Inc*

It is important that instrumentation be considered an integral part of the original design of treatment facilities. Otherwise, ease of control can be greatly affected by characteristics of the treatment units. We have seen good control instruments fail to do their job because of unfavorable physical factors. Oversized control valves, or undersized supply lines, reaction tanks conducive to short (*Continued on page* 196)

SUPERCHARGED GAS ENGINE drives generator in power plant. It develops 1700 hp from eight 15½ × 22-inch cylinders →



By R L BOYER
Vice-President in charge of Engineering
The Cooper-Bessemer Corporation

Current trends in fuel supply and prices put emphasis on the spark-ignited gas engine. In new, improved forms this familiar prime mover is making a vigorous comeback. Here is a first report on steps that lead up to . . .

Developing Supercharged Gas Engines

► SOUND AND COMPELLING REASONS lie behind the fact that a high percentage of American diesel engines are built in supercharged form. Power increase through supercharging normally approximates 50% and can go as high as 100% with improved methods. While engine cost also increases, it does not do so in proportion to power gain. So cost per horsepower is normally less for supercharged engines.

Other Advantages. Supercharging involves practically no increase in space and weight, in foundation and building size. Heat dissipation from engine does not rise. Thus cooling equipment adequate for an atmospheric engine will also serve its more powerful supercharged counterpart. Maintenance cost per hp has been shown to be less for the supercharged engine. All these factors account for customer preference.

Practically all supercharging of heavy-duty diesel engines has been by means of the turbocharger. In such a unit, engine exhaust powers a gas turbine, which drives a centrifugal blower supplying the air. The diesel lends itself well to this scheme because its high compression ratio results in an exhaust temperature low enough to permit use of the turbine.

Valve Overlap. Many years ago, engineers found that thorough scavenging was essential to the supercharging process. In fact, improved scavenging contributes as much as the actual supercharging. Increased scavenging comes from greater "overlap" of intake and exhaust valves. This permits scavenging air under pressure to blow through the cylinder and out the exhaust valve, thoroughly cleaning the cylinder each cycle. Fig. 1 compares timing diagrams of atmospheric and supercharged engines. Note that the supercharged engine uses as much as 180 deg total valve overlap.

Gas-Engine Operation. Until recently, supercharging has not appeared on gas (gaseous fueled) engines, and for sound reasons. Until the developments discussed here, gas engines were built on the principles of (1) perfect mixture of air and fuel (2) constant-quality mixture.

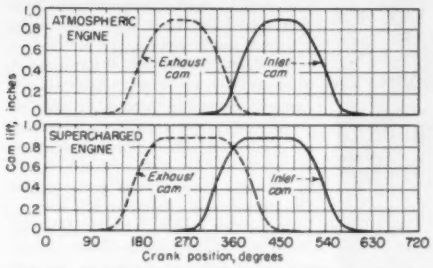
By *perfect mixture* we mean one that maintains just the right ratio of gas and air so combustion is a complete chemical reaction. The usual mixing valve, Fig. 2, can be adjusted to vary relation between gas and air but holds that adjustment throughout load changes.

Maintaining a chemically perfect gas-air mixture leads automatically to a high exhaust temperature. At all loads this temperature runs higher than can be permitted on gas-turbine blading and it is doubtful if even the most recent developments in blading alloys would withstand the exhaust of a mixing-valve gas engine.

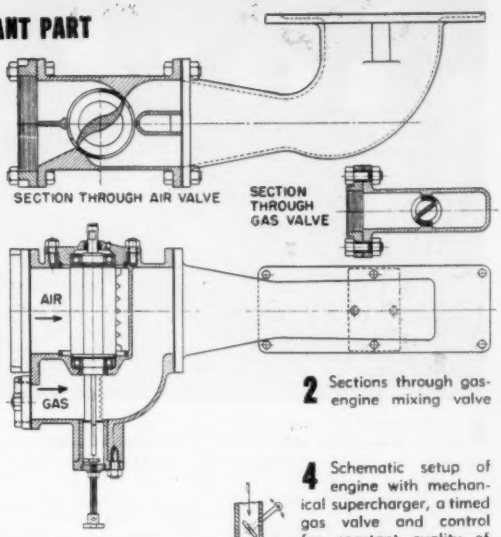
And with air and gas mixed before entering the engine, it is apparent from Fig. 1 that a large part of the gas and air charge would be lost to the exhaust if we attempted to use large valve overlaps on a gas engine. These form the two main reasons why gas engines have not been supercharged.

Mechanical Supercharging. In our first attempt to supercharge a gas engine we used a mechanically driven

VALVES AND VALVE TIMING PLAY AN IMPORTANT PART

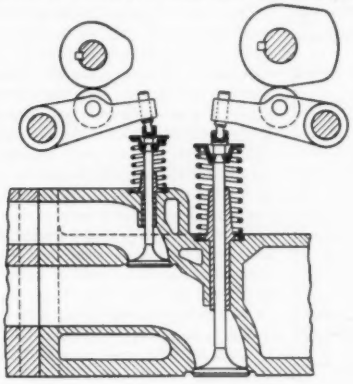


1 Cam-lift curves show difference in amount of valve overlap between atmospheric and supercharged engine

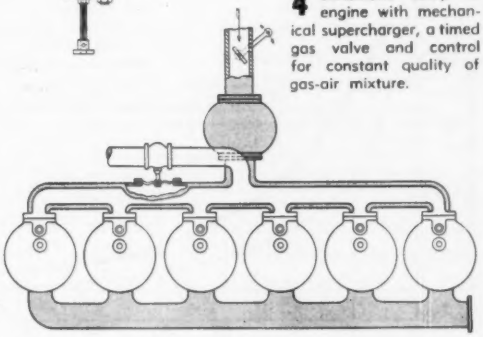


2 Sections through gas-engine mixing valve

3 Diagram shows introduction of gas to the intake air stream by means of a timed, cam-actuated gas valve



4 Schematic setup of engine with mechanical supercharger, a timed gas valve and control for constant quality of gas-air mixture.

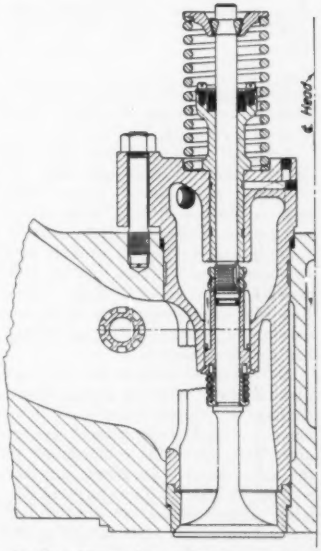


blower to avoid effect of high temperatures on a turbine. Gas admission was timed so scavenging was with pure air. Fig. 3 shows the method diagrammatically. Gas was introduced into the inlet air stream so air could be timed ahead of gas. Over-all arrangement, Fig. 4, shows the idea was to supercharge the engine mechanically but, through control equipment, to attempt to maintain a constant-quality mixture (Patent No. 2,375,071). Later developments demonstrated that trying to maintain a perfect mixture was not the solution.

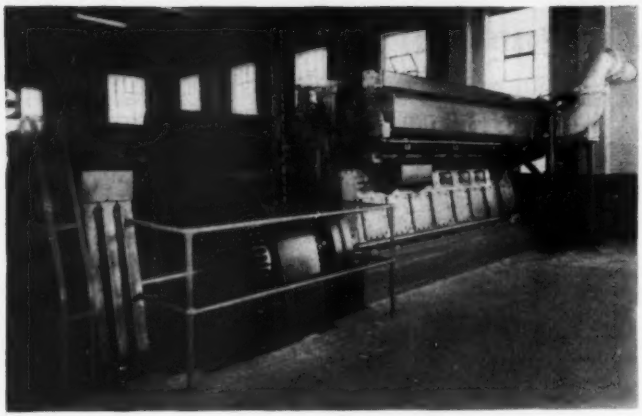
Gas-Diesel Development. It remained for the gas-diesel development to show us things about the gas engine not known before. We introduced our gas-diesel commercially in February 1945. Development of the supercharged gas-diesel was carried along with that of the atmospheric design. It incorporated timing of gas admission as in Fig. 3. Actual gas-injection valve now used on these supercharged engines is shown in Fig. 5. Because of the sleeve on the gas valve, air valve opens considerably ahead of gas and gas closes ahead of air. Gas valve seats positively between times to prevent gas leakage around sleeve.

The surprise for gas-engine designers came when gas-diesel development showed that full diesel compression could be carried on a gas-air mixture without preignition. With the chemically perfect mixtures that had been thought necessary, this was not possible. Successful gas-diesel operation was achieved and preignition avoided by keeping the mixture very lean. Diesel efficiency was then easily attained and bettered. It was also found that gas-diesel exhaust temperatures ran about the same as those of oil diesels, or even a little lower.

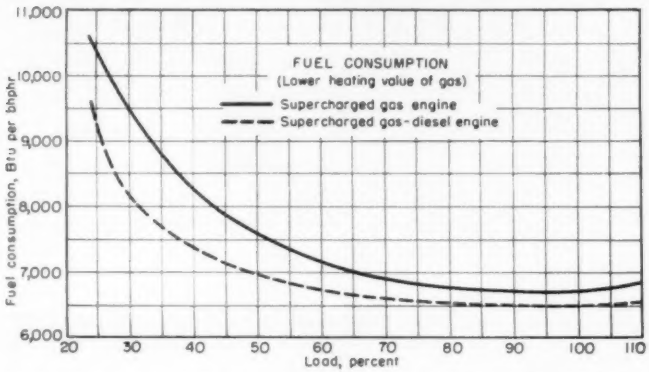
Light-Load Economy. An important question with gas-diesel (or dual-fuel) engines was that of obtaining good economy at light loads. First engines took in a full air charge regardless of load. Since gas intake varied with load, mixtures became much too lean at light loads and some unburned gas went out in the exhaust. Air throttling in accordance with load corrected this, and rep-



5 Supercharged gas diesel uses timed gas valve mounted on air-inlet valve



6 Supercharged gas engine driving a generator with V-belted exciter in a power plant. Engine has eight 13x16-in. cylinders, is rated 1200 hp at 450 rpm



7 Fuel-consumption curves for supercharged gas-diesel and supercharged gas engine show the latter to be slightly higher. Difference is only 200 Btu at full load.

resented a return to the constant-quality principle even though this engine operated on a relatively lean mixture.

Variable pilot-oil timing also improves light-load efficiency. Both air throttling and pilot-oil timing were made a function of load, under governor control. Resulting performance appears in Fig. 6. Pilot oil is easily held to about 4% of full-load heat input. A general patent, applied for in connection with this development of the supercharged version of the gas diesel, has now been allowed.

As soon as we realized we could employ full diesel ratios on gaseous-fueled engines, we started thinking of developing a straight supercharged gas engine. With the timing combinations of the supercharged gas-diesel, together with its variable air throttling and variable pilot-oil timing, we already had the making of the supercharged spark-ignited engine. It seemed that only development of proper ignition remained.

Ignition System. In the meantime, we had been working on an ignition system for our 2-cycle turboflow gas engines and then for the 4-cycle version of the same type. High compression and lean mixtures in these engines presented ignition problems. High compression meant much higher secondary voltage and we found no standard ignition coils or spark plugs equal to it.

The problem of lean mixtures was a confusing one, quite opposite in nature to that of mixing-valve engines. In the latter, much higher ignition voltage is needed at full load than at no load. With our turboflow engines, no-load voltage is higher than full-load in spite of constant compression ratio. We found the reason in the mixture ratio, since in that type of engine, mixture is much weaker at light loads.

Since operating conditions were radically different from previous engines, a large number of tests was needed to work out an ignition system that would function properly. The solution was found only after tests under all conceivable conditions.

Light-Load Problems. Having developed a fully satisfactory ignition system, we were confronted at the test stage with a new problem. As pointed out above, air throttling is needed to secure good light-load efficiency on the gas diesel. It is equally necessary on the straight gas engine. We learned from the gas engine, however, that this throttling at light loads draws considerable exhaust gas back into the cylinder, because of the long overlap. In the gas diesel this is not injurious, but in the gas engine it causes missing at light loads. This would be intolerable on ac generator sets.

This led to a great deal of further experimentation, out of which came quite an alteration to the valve-timing diagram to fully correct the missing. These changes have been incorporated in the engine so it now performs perfectly at all loads. Its fuel consumption, Fig. 7, is nearly as good as the gas diesel at full load. While not as good at light loads, it is certainly well below what we hoped to get.

These supercharged gas engines have been built in several sizes; the first was shipped in the latter half of 1949. Fig. 6 shows the 13x16-in. 8-cyl engine rated 1200 hp at 450 rpm. Unit illustrated at beginning of this article is a 15½x22-in. 8-cyl engine rated 1700 hp at 327 rpm.

Application Economics. A development such as this has value only if it has real economic applications. Naturally, there is no interest in any type of gas engine where gas is not available. In such areas an oil diesel proves the logical answer.

A comparison of fuel economics between this new gas engine and the diesel engine proves interesting. Fig. 8 tells the story graphically. The relative costs, of course, depend on prices of fuel oil and gas. At this writing, 10c per gal represents a good average for fuel oil throughout most of the country. Cost of gas is extremely variable from area to area. With oil at 10c, the supercharged gas engine shows a lower fuel cost up to a gas cost of about 73c. Since we seldom find gas costing more than this, we can say that supercharged-gas-engine fuel cost is lower under all circumstances.

Many of our plants operate on 20c gas. Fig. 8 shows an annual saving in such cases, of more than $30,000 per 1000 hp developed. It is apparent therefore, that in any area where gas is available and supply is assured, this engine has an economic edge over an oil diesel.

Gas-Diesel Comparison. In recent years, the gas-diesel or dual-fuel engine has gained a prominent place in power generation. It combines the above relative advantage over the oil engine with the added virtue of being instantly convertible to oil if gas fails. The supercharged gas engine is not instantaneously convertible although it may be changed to a diesel in a matter of one to four hours, depending on engine size. Because the supercharged gas engine does not use any pilot oil, it shows a fuel-cost advantage over the gas diesel at most normal oil costs. This holds up to relatively high gas costs, after which the gas diesel may have a slight advantage.

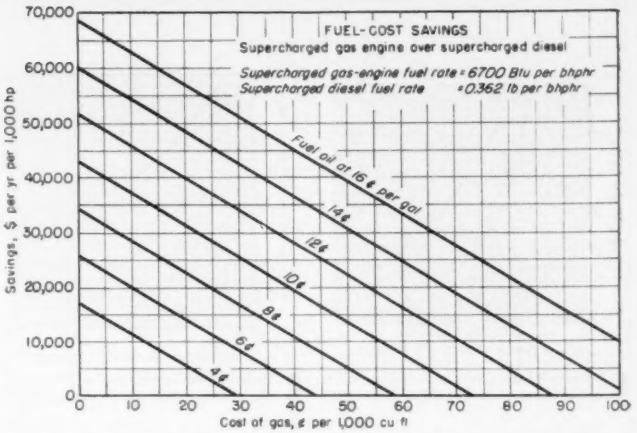
The reason is that thus far the total Btu consumption of the supercharged gas engine is slightly higher than that of the dual-fuel engine. With today's pace of development, however, the supercharged gas engine may soon equal the gas diesel in Btu per bhphr. Even now it is only 200 Btu higher at full load.

Fig. 9 shows that with 10c oil the supercharged gas engine has a fuel-cost advantage up to about 43c gas. With 20c gas and 10c oil, the gas engine shows an annual saving of over $1000 per 1000 hp compared with a gas diesel. This is based on 5% pilot-oil use. If pilot oil is more than 5%, the supercharged gas engine has a greater edge.

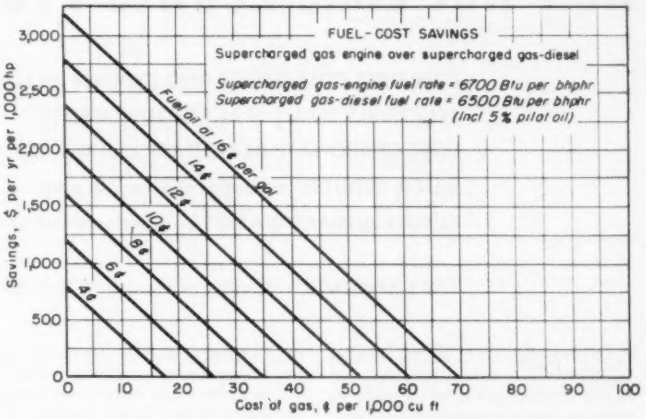
Gas-Engine Comparison. Chief interest lies in the economics of the supercharged gas engine and the orthodox spark-ignited gas engine, which has been so widely used. Wherever the gas engine has been installed in the past there is, obviously, a dependable supply of gas at an economical price. In the power-generation field, practically all these engines have been 4-cycle. The most popular type of compressor gas-engine is 2-cycle, but it has never found favor in power generation because of its irregularity at partial loads.

The 4-cycle engine has actually produced a bhphr for about 9500 Btu. Taking this as a basis, Fig. 10 shows relative fuel-cost advantage of the new engine over the older type. With 20c gas, annual saving comes to $5000 per 1000 hp. With 65c gas, which happens to be prevailing rate at our Grove City, Pa. plant, the annual saving stacks up to $16,000 per 1000 hp.

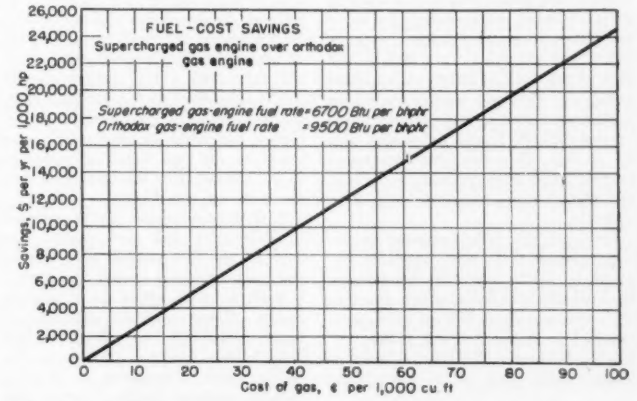
From all the above it is apparent that the supercharged gas engine will receive serious consideration in many areas. It is not represented as economically right under all conditions. The curves permit the power user to decide intelligently whether it meets his conditions.


FUEL-COST SAVINGS
Supercharged gas engine over supercharged diesel
Supercharged gas-engine fuel rate = 6700 Btu per bhphr
Supercharged diesel fuel rate = 0.362 lb per bhphr
Fuel oil at 16¢ per gal
14¢
12¢
10¢
8¢
6¢
4¢
Savings, $ per yr per 1,000 hp
Cost of gas, ¢ per 1,000 cu ft

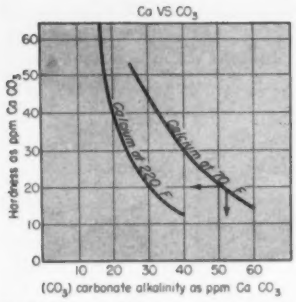
8 Chart permits comparison between supercharged gas engine and supercharged oil diesel for various fuel prices. Annual saving shown in dollars per 1000 hp


FUEL-COST SAVINGS
Supercharged gas engine over supercharged gas-diesel
Supercharged gas-engine fuel rate = 6700 Btu per bhphr
Supercharged gas-diesel fuel rate = 6500 Btu per bhphr
(incl 5% pilot oil)
Fuel oil at 16¢ per gal
14¢
12¢
10¢
8¢
6¢
4¢
Savings, $ per yr per 1,000 hp
Cost of gas, ¢ per 1,000 cu ft

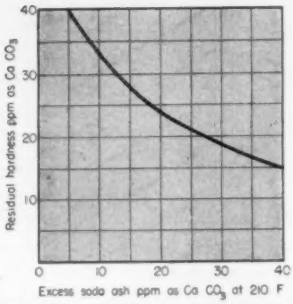
9 Comparison between supercharged gas engine and supercharged gas-diesel engine shows fuel-cost savings at various fuel prices. Pilot-oil use assumed as 5%


FUEL-COST SAVINGS
Supercharged gas engine over orthodox gas engine
Supercharged gas-engine fuel rate = 6700 Btu per bhphr
Orthodox gas-engine fuel rate = 9500 Btu per bhphr
Savings, $ per yr per 1,000 hp
Cost of gas, ¢ per 1,000 cu ft

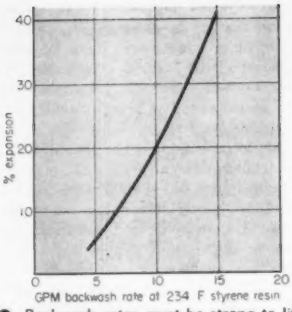
10 Here the supercharged gas engine is compared with the orthodox 4-cycle mixing valve type of gas engine. Fuel-cost savings shown for a range of fuel prices



1 Carbonate alkalinity reduced more by hot-process than cold-lime treatment



2 Residual hardness can be dropped by increasing excess amount of soda ash



3 Backwash rates must be strong to lift zeolite enough to assure full cleaning

New Hot Lime-Zeolite Process Offers...

LOW FIRST COST, OPERATING EXPENSE for high makeup needs

RELATIVELY SMALL SPACE REQUIREMENTS

LOW CARBONATE ALKALINITY and low CO_2 in steam

SILICA REDUCED to under 0.5 to 1.0 ppm

TURBID SURFACE WATERS handled without preclarification

By S B APPLEBAUM, *Manager, Cold Process Div, Cochrane Corp*

► THE COMBINATION of hot process sodium zeolite is only a few years old in this country, although it was reported in use in Germany before World War II[1]. Styrene resins have made the method practical. This class of resin gives a cation exchanger capable of withstanding boiling and highly alkaline waters without deteriorating. So far it has withstood water temperatures over 250 F, and pH values over 10.5 to 11.0 with no top limit of either as yet found damaging. Previous zeolites or cation exchangers failed at water temperatures beyond 120-140 F, and pH values over 8.5 to 9.5. This new water-treatment process gives high promise especially for high boiler pressures and high makeups.

Let's put this new treatment to the test, compare it to other methods, examine its limits, study its advantages. We are talking of boiler plants developing a pressure above 500 psi with steam supplied to turbines. Such boilers require a feedwater like that outlined in Requirements, top of p 116. What water-treatment methods are there that could supply a water of this quality?

Today there are several treatments for high-pressure boiler service, but in one or more particulars they fail to meet the specified water. Let's examine them.

1. *Sodium zeolite plus sulfuric acid* followed by deaeration and then caustic feed produces a "zero" hardness water of low carbonate alkalinity with a high pH value and a low oxygen content. Yet it falls short of our specified water on two counts: (1) Silica is not reduced. (2) Total dissolved solids, compared to the raw water or compared to the effluent from the other treatment methods, stay too high.

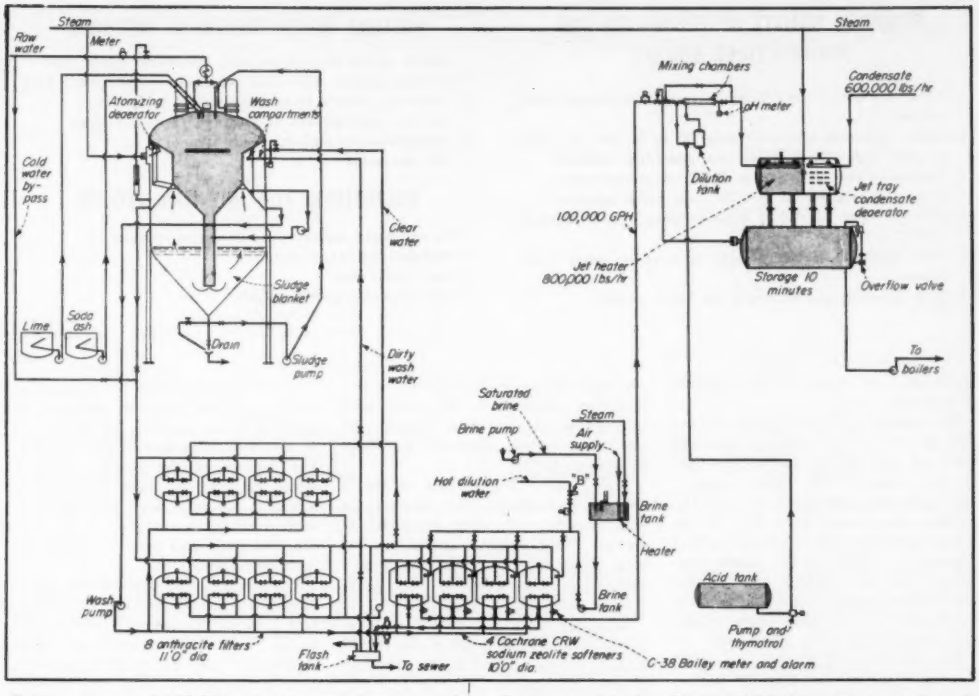
2. *Hydrogen-sodium zeolite* followed by deaeration and then caustic feed does all the first method accomplishes and goes one step farther. In method 1 sulfuric acid added to a sodium-zeolite effluent converts sodium-bicarbonate alkalinity to sodium sulfate. This action increases the total dissolved solids. Contrasted to this the hydrogen-sodium zeolite process converts bicarbonates to carbonic acid and this, in turn, is liberated by aeration or decarbonation. The result is a treated water of much lower dissolved solids that saves on boiler blowoff. But this method does not reduce silica.

3. *Cold lime followed by acid and sodium zeolite* produces a water that meets nearly all the specifications above except: (a) Silica is difficult to remove below 2 to 3 ppm from a cold-temperature water. Hot-process treatment reduces silica from the same water with less reagent to 0.5 to 1.0 ppm. (b) Carbonate alkalinity cannot be reduced as much with cold-lime treatment as with hot process, Fig. 1. You have to use acid to supplement reduction of carbonates and this will reduce the pH value. Caustic soda has to be added after the deaerator if you want to hold a high pH. Requirements, top of p 116. (c) Total solids run higher than they would with hot lime zeolite.

But this method still finds application where cold water must be treated for cooling water in the plant, or where a single water treatment is preferred for both cooling water and boilers.

4. *Hot lime soda followed by phosphate* (2-stage hot process) including deaeration gives "zero" hardness water

[1]Cems. Hall Laboratories. **Report on German Water Treatment Practices.** Engineers' Society of Western Pennsylvania. 1947.



4 Flow diagram of 100,000 gal-per-hr unit shows setup that permits backwashing zeolite units with a hot filtered water. Frequency of backwashing is highly important to system effectiveness; hot water reduces thermal strain on the beads

of high pH value, low oxygen, low silica and lower total solids than the raw water if the latter contains appreciable alkalinity.

But remember in the first stage you use an excess of soda ash, about 2 gr per gal or 34 ppm expressed as $CaCO_3$, to reduce hardness to under one gr per gal, or 17 ppm, Fig. 2.

Monosodium or disodium phosphate then goes into the water in a second stage to remove the remaining one gr per gal and convert it in part to soda ash. Because of this, carbonate alkalinity of the treated water goes over 50 ppm as $CaCO_3$ and with a makeup approaching 100%. CO_2 in the resulting steam reaches as high as 20 ppm instead of a desired 10 ppm tops. An acid added to the effluent reduces the carbonate partly to bicarbonates and carbonic acid. Following this up with external deaeration to get rid of the carbonic acid results in removal of the objectionable CO_2.

But the job is still not over. After deaeration caustic soda should be added to raise the pH to the level desired. Requirements, top of p 116. This procedure makes the chemical control rather complex and increases operating costs above those of the hot-process system using lime alone without soda ash followed by hot zeolite.

One important advantage of the 2-stage hot lime soda followed by phosphate method just described is that the two stages may be made exactly alike in design. The second-stage tank can be used alone, when the first-stage settling tank is being cleaned.

Some installations have three settling tanks, each providing 30-min. retention. The first two in parallel constitute the hot lime-soda stage, and the third the phosphate stage. When any of the three tanks have to be cleaned the other two serve for the two stages.

Major disadvantages of the 2-stage hot lime soda plus phosphate are: (a) Space requirements for second- or phosphate-stage settling tanks are high. (b) Phosphate excess must be held to about 5 ppm as PO_4 in final effluent to depress hardness to "zero." This sometimes causes calcium phosphate deposits in stage bleed heaters or economizers because of increase in temperature. Acid must then be added to hold pH value down under 9.5. (c) Controls, often complicated, are needed for lime, soda ash, phosphate and frequently acid feed. (d) Operating cost runs high because of soda ash and phosphate.

5. *Demineralizing plus anion-silica removal* is a method that has been growing in popularity especially for boilers operating above 900 psi. It produces a water of very low silica (under 0.2 ppm). It is the only method other than evaporation to give a water free from appreciable sulfates and chlorides so total dissolved solids or electrolyte is under 5 to 10 ppm. Central stations with low percentage of makeup have adopted it. Its only shortcoming in regard to water specified (Requirements on p 116) is a pH under 9.0. A post treatment of caustic takes care of this.

Cost of Operation. High first cost and operation are its only disadvantages. First cost ranges between $100 and $500 per gpm depending on water composition, and plant size.

Operating charges can be worked out as follows: The first or cation hydrogen-zeolite stage requires about 0.25 to 0.5 lb of sulfuric acid per 1000 gal per gr per gal of total cation removed as $CaCO_3$. Acid costs 1 to 1.5c per lb

REQUIRED QUALITY OF FEEDWATER FOR HIGH-PRESSURE BOILERS

1. *Silica*—less than 0.5 to 1.0 ppm to avoid silica deposits in the turbines
2. *Sodium carbonate alkalinity*—under 20 to 25 ppm as $CaCO_3$ to avoid high CO_2 in steam- and return-line corrosion
3. *Hardness*—"zero" (0-2 ppm as $CaCO_3$) to prevent scale
4. *Oxygen*—0 to 0.005 ml per l to avoid boiler corrosion
5. *pH value*—over 9.5-10.0 to avoid corrosion of the feedwater system
6. *Total solids*—as low as possible in order to reduce boiler blowdown
7. *Cost*—operating and investment—as low as possible

POSSIBLE WATER-TREATMENT METHODS

1. Sodium zeolite plus sulfuric acid, deaeration, caustic feed
2. Hydrogen-sodium zeolite followed by deaeration, caustic feed
3. Cold lime followed by acid and sodium zeolite
4. Hot lime soda followed by phosphate (2-stage process)
5. Demineralization plus anion-silica removal
6. Hot lime zeolite

PRECAUTIONS FOR HOT LIME ZEOLITE

1. Do not subject zeolite to greatly varying temperatures
2. Backwash zeolite once daily
3. Keep zeolite clean
4. Hold influent as clear as possible

depending on location and method of purchase.

The second or anion stage takes about 0.25 to 0.35 lb of caustic soda per 1000 gal per gr per gal of the sum of the residual CO_2, silica, sulfates and chlorides expressed as $CaCO_3$. Caustic soda costs 2.5 to 3.5c per lb, again depending on location and method of purchase. Table I, p 117, shows operating cost for typical low sulfate and chloride water. Table II gives costs for waters having higher silica sulfate and chloride and lower alkalinity.

But even these high operating costs may be justified for 1200-psi boilers requiring low silica and low total solids from a cold-process-treated water. Several central stations have recently selected this demineralizing process in preference to evaporators or other methods. Simplicity of piping, deaeration and pumps, flexibility for a varying heat balance and single control of treatment won over one such central station to demineralization as against a proposed system of segregating condensate for the 1200-psi units and treating the makup water for lower-pressure boilers only.

6. *But the hot lime-zeolite method* applies more generally at both lower first cost and operating expense for the usual industrial boiler with high percentage of makeup. This method employs lime to reduce both bicarbonate hardness and silica, and follows up with sodium zeolite to complete hardness removal. Deaeration takes care of any dissolved oxygen. The pH is over 10.0 and needs no reduction either before or after the zeolite. If magnesium hardness precipitated by the lime is not enough to reduce silica to under 1.0 ppm, dolomitic lime, or sometimes activated magnesia, can be used to supplement the hot-lime treatment.

By omitting soda ash in the normal standard hot process and using lime alone, carbonate alkalinity can be depressed to 20 to 25 ppm depending on calcium content in lime-treated water. Reducing alkalinity to this value with lime alone requires that hardness of raw water exceed alkalinity by about 25 ppm as $CaCO_3$.

Fig. 1 shows relationship of Ca to CO_3 in the effluent. By keeping Ca high enough, CO_3 stays depressed as desired. This method, therefore, has been christened the "excess calcium"[2] method as contrasted to the usual "excess soda ash" method.

Advantages are: (a) Small space required compared to 3 and 4 (b) turbid surface waters handled without preclarification as against 1 and 5 (c) pH-controlled chemical feed results from use of lime without soda ash and meets raw water changes automatically (d) low carbonate alkalinity and hence low CO_2 in steam without post acid treatments, 3 and 4 (e) no post-phosphate deposits in stage bleed heaters or economizers (f) sodium zeolite serves as a safety factor to scavenge residual hardness even if lime pretreatment varies (g) low operating cost.

Precautions. To be sure of getting all the advantages outlined above there are certain precautions to take. Requirements, given above. Recent short-time laboratory tests[3] show styrene resin withstands repeated thermal changes without damage. Yet it is prudent to design the plant so as to avoid damage from this cause, certainly over long operating periods. The easiest way of doing this is not to subject the zeolite to greatly varying temperatures, which might exaggerate the thermal strain.

Using hot water for backwashing and rinsing the regenerating brine from the zeolite and keeping the brine itself hot will hold zeolite within a sensible temperature range. Hot settled water can be used for backwashing and its effluent recovered back to the settling tank.

[2]**Conditioning Makeup by High-Temperature Sodium Ion Exchange**, FN Kemmer, **Combustion**, April 1950.
[3]Lindsay, Wirth and Durinski—**Ion Exchange in High-Temperature Industrial Applications**, American Chemical Soc, Sept 4, 1950.

If cold water is used for rinsing the brine, a second operating difficulty, in addition to the possible thermal strain on synthetic resin beads, may develop. The bottom of the zeolite softeners would fill up with hard, undeaerated water. A hot rinse with soft deaerated water would have to follow to displace this cold water and prevent it discharging to the boilers.

The frequency of backwashing bears directly on the effectiveness of the hot-lime process. No matter how often the zeolite needs regeneration it should be backwashed once daily. In the hot-lime process the styrene resin has a high capacity, its bed is 24 to 30 in. deep, operating rate runs 5 to 6 gpm per sq ft. All result in a volume of zeolite capable of operating several days between regenerations. But backwashing every 24 hr will avoid channeling and hardness breakthrough in very long runs from any cause, such as traces of suspended matter from filter effluent that collect on top of the zeolite.

This problem of suspended matter on the zeolite raises one more operating precaution. Zeolite should be kept clean. Hot process-effluents are stable and do not tend to form adherent deposits on zeolite granules as happens with cold-lime treatment. But the zeolite acts as an excellent filter. It collects traces of suspended matter in the filtered effluent on the top of the bed. This matter then mixes in with the zeolite and only backwashing removes them. Since hot water as a backwash has low viscosity and lifting power to expand the bed, a rate similar to hot-process filter wash is used.

A further way of keeping the zeolite clean is to take steps to be sure the influent is as clear as possible. To assure a settled effluent of low turbidity at all times use only the most modern design of hot-process settling tank. Sludge contact with suspended sludge, including sludge recirculation or the downflow sedimentation tank with

I: DEMINERALIZING, SiO_2 REMOVAL COST—LOW SOLIDS

Ca	70	HCO_3	80
Mg	20	SO_4	20
Na	30	Cl	20
Total cations	120 ppm as $CaCO_3$		120 ppm $CaCO_3$

SiO_2 5.9 as $CaCO_3$

Residual CO_2 after first stage and decarbonator 6.0 as $CaCO_3$

Sulfates and chlorides or TMA 40.0

Total cations 120 ppm

Total for anion unit 51.9 ppm

$$\frac{120}{17.1} = 7 \text{ gr per gal}$$

$$\frac{51.9}{17.1} = 3.1 \text{ gr per gal}$$

Acid $0.30 \times 7 \times 1.5c = 3.2c$ per M gal

Caustic soda $= 0.30 \times 3.1 \times 3.0c = 2.8c$ per M gal

Operating cost total $= 3.2 + 2.8 = 6.0c$ per M gal

II: RESULTS IN PPM AS $CaCO_3$—COST OF DEMINERALIZING, SiO_2 REMOVAL HIGH SOLIDS

Ca	120	HCO_3	80
Mg	60	SO_4	100
Na	60	Cl	60
Total cations	240 ppm	Total anions	240 ppm

$$\frac{240}{17.1} = 14 \text{ gr per gal}$$

Silica	12.6 as $CaCO_3$
Residual CO_2	6.0 as $CaCO_3$
TMA (SO_4 + Cl)	160.0 as $CaCO_3$
Total for anion unit	178.6 ppm as $CaCO_3$

$$\frac{178.6 \text{ ppm}}{17.1} = 10.4 \text{ gr per gal}$$

Acid $= 0.35 \times 14 \times 1.5c = 7.3c$ per M gal

Caustic soda $= 0.30 \times 10.4 \times 3.0c = 9.4c$ M per gal

Total operating cost: $7.3 + 9.4 = 16.7c$ per M gal.

---

sludge recycling, are well justified. Sometimes small amounts of coagulant help reduce turbidity of settled waters to 2 to 5 ppm. For this same reason filters between settling tanks and zeolite softeners are desirable and act further as a safety factor to protect zeolite.

There is some interest in the possibility of using existing hot-process anthracite filters for softeners by merely replacing anthracite with styrene-type resins. Where this is tried it is still more imperative to use coagulant and design the settling tank very conservatively in diameter, as well as to provide for sludge contact to give turbidities approaching 2 ppm at all times. Furthermore, perfect operation of pretreatment chemical control is needed.

Where filters are omitted, make zeolite softeners large enough to hold flow rates under 3 gpm per sq ft of total area with one unit out for regeneration. Rotary surface washers should be made a part of the softeners to help clean up the zeolite. About twice as much zeolite is needed at a softening rate of 3 gpm per sq ft without filters as is required for 6 gpm per sq ft with filters. So the savings in zeolite costs offset the expense of filters.

Tests made for nine months with hot-zeolite softeners using unfiltered settled water from an existing hot-lime-soda plant produced a soft water containing several ppm of hardness due to channeling caused by precipitate. Then the same hot-zeolite unit, operated for several months on filtered water, produced a soft water that was really zero in hardness. For high-pressure boilers zero hardness is essential. So use filters wherever possible.

Case History. In the above paragraph we referred to an operating experience. Let's look at this case a little closer. It was an Ohio chemical plant that had operated a 100,000-gph hot-lime soda water softener for several years. It produced a treated water containing a hardness from a half to one gr per gal and silica under 1 ppm. Because of higher boiler loads and other changes, "zero" hardness water was desired.

First thought was to add a second settling tank, thereby giving a 2-stage hot-lime-soda hot-phosphate plant. Chemical operating costs for such a system would have run 2.5¢ per 1000 gal of treated water. Anhydrous disodium phosphate costs would have run 0.8¢ per 1000 gal; soda ash, 100%, 1.3¢ and Ca $(OH)_2$, 100% 0.4¢.

Sodium chloride brine can be had at this plant at a very low cost.

Under such a favorable condition, cost comparison between 2-stage hot-lime soda phosphate plant and a hot-lime zeolite one indicated a saving of over $10,000 per year in operating costs alone. The estimated savings in investment including buildings and erection amounted to about $40,000.

A pilot hot-zeolite unit was installed early in 1950 to treat some of the hot-lime-soda water. This pilot unit, 12 in. dia, originally carried a 2.0-cu-ft bed of styrene resin zeolite. Later another 0.5 cu ft went in. Eleven runs had been made at last report on this unit with each run lasting 3 to 4 weeks. Hardness of the hot-lime-soda treated water entering the pilot unit averaged about 0.5 gr per gal because over 3 gr per gal of excess soda ash was used. Capacity obtained on the zeolite is about 25,000 to 30,000 gr per cu ft using 9 lb of salt per cu ft. Runs of over 200,000 gal between regenerations have been tallied at an average rate of 5 to 6 gpm or about 7 gpm per sq ft. Rates as high as 10 to 12 gpm per sq ft have passed through with a loss of head of less than 10 psi.

The earlier runs were made on unfiltered settled water and later runs on filtered water. Backwashing took place every 24 hr when unfiltered water was used. On the last two runs, numbers 10 and 11, filtered water was used and backwashing was then needed only every two days. The average effluent showed a few ppm of hardness due to occasional channeling and breakthrough of hardness when unfiltered water was used. This is a testament to the importance of using filters ahead of zeolite.

Because this pilot plant operated so well and the expected savings in cost seemed so worthwhile the management decided to put in a 100,000-gal-per-hr hot-zeolite plant, Fig. 4, consisting of four 10-ft-dia units. These zeolite units will be backwashed with hot filtered water from a compartment in the settling tank. Dirty wash water will be recovered in another compartment, Fig. 4.

Next month POWER *will run a report on a full-scale industrial installation using the hot zeolite process.*

ELECTRONICS FOR THE POWER ENGINEER

By F A ANNETT, *Associate Editor*

34—Motor and Generator Exciters: Part 2

► A WIDE VARIETY of electronic exciters have been developed for dc motors and generators used on variable-voltage control systems. Some of these exciters are simple and supply only the exciting current, while others control generator voltage and motor speed. Here we will study a simple control of the latter design.

Generator and Motor Controls. The diagram is for a Westinghouse electronic exciter system for dc generators and motors in variable-voltage speed-control equipment. It consists of two independent exciters mounted on one panel. Each exciter has its own set of tubes—T_1 and T_2 for the generator-field coils, and T_3 and T_4 on the motor-field coils. Cathodes of these tubes are heated by secondaries S_3 and S_4, which are part of a transformer not shown.

Generator exciter is a simple grid-controlled rectifier that supplies a variable voltage to the generator-field coils. Output of the rectifier is controlled by a resistor-capacitor phase-shift circuit, part of the resistor being the speed adjuster in the control station. When motor speed is increased above base by field control, its exciter has a grid control similar to the generator, as in the diagram.

Motor-Field Relay. When the control and exciter transformers are energized, secondaries S_1 to S_6 are made alive. Secondaries S_6 energize the time-delay relay and it starts timing out. In about 30 sec it closes contact TD to cut R_{12} out of the phase-shift circuit, and to permit generator-field exciter tube T_1 to conduct when the cathodes have been heated. When secondary S_1 has the polarity shown, current flows through field-relay coil FL, motor shunt-field coils, to center tap on S_4, cathode and anode of T_3 to + on S_1.

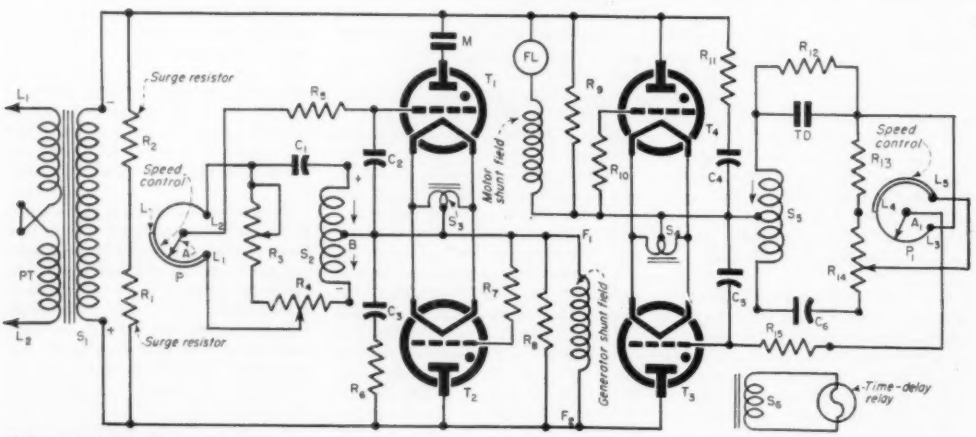
Coil FL closes a contact in the motor-generator start circuit (not shown) that permits energizing the coil that closes contact M in the anode connection of the generator-field exciter. Relay FL prevents exciting the generator-field and applying voltage to the motor armature until its field is excited.

Generator-field coils are excited through tube T_1 when polarity of S_1 reverses. This circuit is from the bottom terminal of S_1 through the generator-field coils to center tap on S_5, cathode to anode of T_1, contact M to top terminal of S_1. While current is increasing in the field coils, induced voltage in them opposes the increase in current. On decreasing current a voltage is induced in the coils that tends to keep the current flowing.

Therefore, when transformer polarity reverses and tube T_1 cannot conduct, the field coils have a voltage induced in them that causes a current to flow through tube T_2. This current flows from F_1 through tube T_2 to F_2 so the tube acts as a discharge circuit of comparatively low resistance. Resistor R_8 also acts in a similar way to keep the induced voltage in the field coils at a low value. The tube in combination with resistor R_8 acts as a filter to maintain current flow in the field coils during reverse polarity of the transformer.

(*Continued on page* 152)

System Adjusts Generator- and Motor-Field Current for Speed Control



VARIABLE VOLTAGE: Electronic exciter system for a dc generator and motor is used as a part of a variable-voltage speed-control equipment. Each exciter has a set of two tubes; one tube serves for rectifying while the other is for field discharge

The All-Purpose Steel Valve!

NEW FIG. 444 SERIES!

1. Yoke Bushing: Hard bronze, lock welded to yoke.

2. Yoke: Forged steel, integral gland rest, screwed and lock welded to bonnet in union type; integral with bonnet in bolted design.

3. Bonnet: Built-in back-seat, big packing chamber; either rolled steel union ring or forged steel stud bolted type.

4. Packing: EValpak, die formed, water-proofed, treated to prevent stem pitting.

5. Gasket: Ironkote 90 Brinnell max. for leak-proof joint.

6. Disk: EValloy 13% chromium or Stellite, slotted or disk nut type, self-centering.

7. Seat: EValloy 13% chromium or Stellite on stainless steel; borized in mated pair with disk.

8. Handwheel: Malleable iron, knobbed for easy gripping.

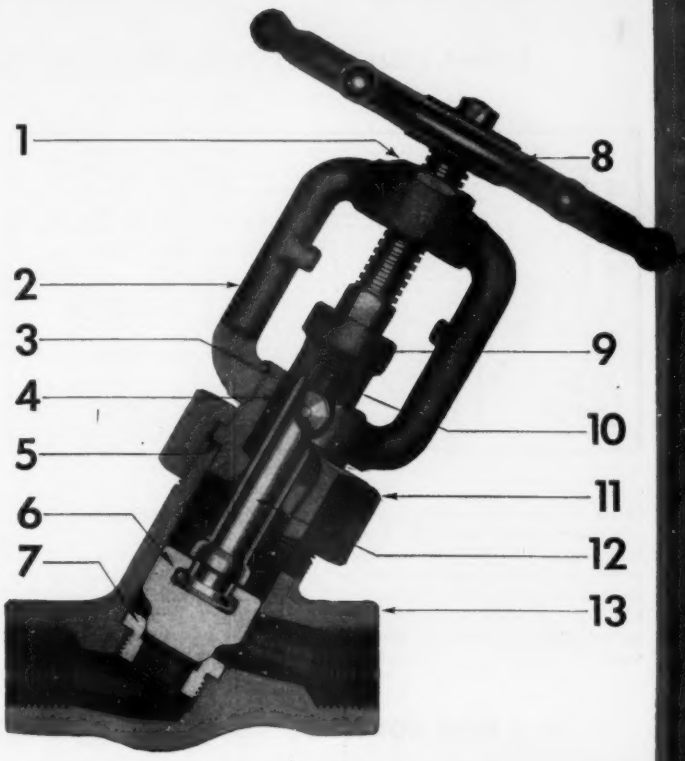
9. Gland: Forged steel, through bolted, accurately fitted to stuffing box.

10. Swing Gland Bolts: Forged steel, EValized for longer, corrosion-free life; swivel out of way but can't come off.

11. Union Ring: Rolled or forged steel, hexagonal.

12. Stem: Hardened, centerless ground EValloy, with backseating shoulder (on disk nut on larger sizes).

13. Body: Heat treated forged steel, inclined stem globe type for lowest pressure loss, screwed or socket welding ends.



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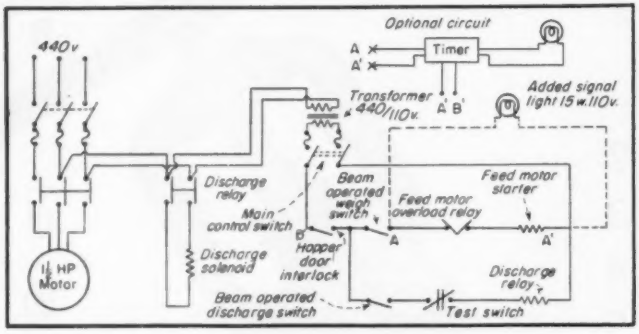
POWER ENGINEERS' NOTEBOOK

PLANT-TESTED IDEAS TO SOLVE PROBLEMS OF DESIGN, OPERATION AND MAINTENANCE

SIGNAL LIGHT TELLS OPERATOR WHEN COAL SCALE STICKS



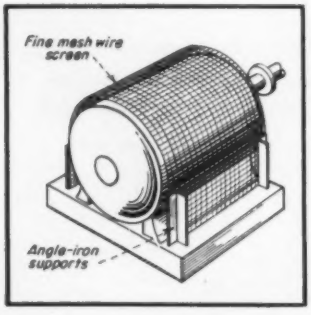
OUR AUTOMATIC COAL SCALES occasionally cause trouble when the hopper sticks open. This stops the automatic feeding of coal. Because the discharge chute is totally enclosed, the lack of fuel goes unnoticed until the steam pressure starts dropping. We have corrected this condition to the best of our ability, but malfunctioning still occurs now and then.

To call the fireman's attention to scale sticking we installed a signal light on the operating board. This is hooked up to the coal-scale circuit as shown in the sketch. The light is on only when the feed motor runs. Having the light on or off doesn't mean the coal scales aren't operating, but the light, by failing to go on and off periodically, shows there is trouble. This simple arrangement does have one drawback. The fireman quickly becomes accustomed to the light going off and on. During light loads the signal is off for extended periods and so he easily overlooks the blinking of the light.

A more suitable system uses a delay timer in the circuit, as shown in the small sketch. This switch normally tends to close, but periodic impulses keep it open. These impulses come from the feed-motor circuit with the switch connected to a constant source of 110 v. The light is then always off unless the scale stops longer than a predetermined length of time. This interval should just exceed the time the scales are idle during lightest boiler loads, but not so long that fuel can run short during heaviest loads. This is seldom less than 20 minutes. Scales trip about every 5 min.

W M MONTGOMERY *Des Plaines, Ill.*

HOW SOME ELECTRIC MOTOR TROUBLES WERE CURED



A CEMENT WORKS has several motors driving rotary kilns. Distance from motors to kilns is only about 3 ft. This used to expose the motors to high-temperature radiant heat, interfering with adequate cooling. We tried two methods of intercepting this radiant energy: (1) a sheet of asbestos between motor and kiln (2) a screen of fine-mesh wire around the motor as shown in the sketch.

The latter method is the more satisfactory. Angle irons at convenient intervals are needed to support the wire mesh. The end bells of the motors are not covered. This allows normal circulation of air, which keeps motor temperatures within normal limits.

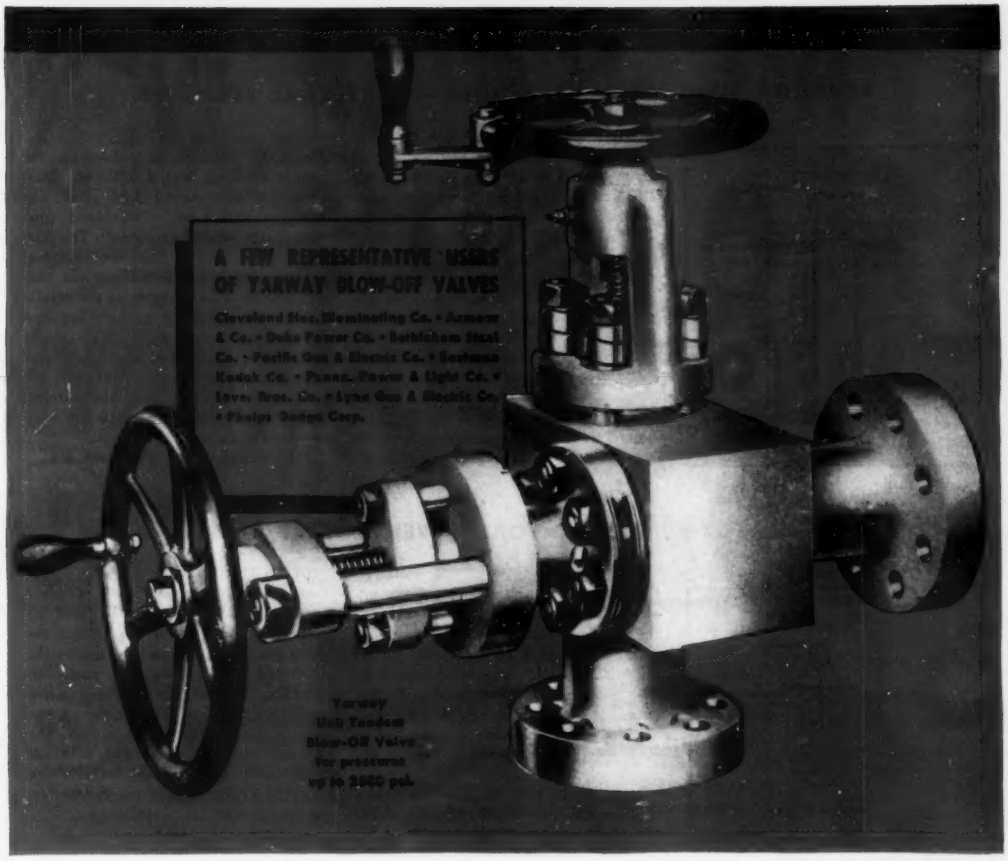
Here's another electric-motor problem we tackled. A motor drives a fan in one of the refrigerated rooms of a cold-storage plant. Stator insulation on this motor failed repeatedly. Within a year two motors were each rewound four times. Whenever the room door was opened, warm air drawn into the motor caused condensation of moisture on the windings. To avoid recurrence of this condition, the fan was relocated so the motor is outside the room in normal temperatures. It drives the fan in the room by an extended shaft that passes through the wall. This arrangement works perfectly so there has been no further motor trouble.

T H CARR *Shipley, Yorkshire*

ONE IDEA IN PRINT...

... is worth 1000 ideas passed by word of mouth. Besides, you have the assurance the printed word is accurate and will reach many more interested people. Send in *your* contribution now—just the facts with sketches in pencil. We'll dress them up for publication and pay you $20 for each helpful idea accepted.

For more plant-tested ideas, turn page



TIGHT! STRONG! for even toughest blow-down requirements

The Yarway Unit Tandem Blow-Off Valve meets the most demanding requirements for boiler blow-down or drain service.

It's drop-tight—and rugged enough to withstand the severe punishment of regular or emergency blow-down under pressure or periodic acid wash.

Two Yarway Stellite-Seat Hard-Seat Valves or a Hard-Seat (blowing) and Seatless (sealing) Valve are combined in a one-piece forged-steel body. Designed for pressures up to 2500 psi.

It is significant that more than 4 out of 5 high pressure boiler plants use Yarway Blow-Off Valves.

For more facts, see Yarway Bulletin B-432.

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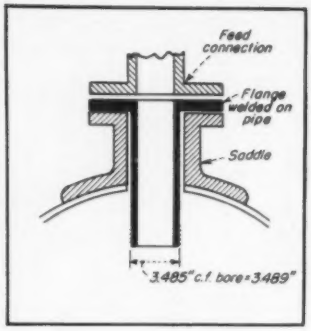
YARWAY

BLOW-OFF VALVES

 Continued from page 120

REDESIGN ELIMINATES LOOSENING OF INTERNAL FEED PIPE

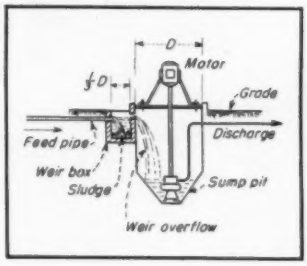


WE WERE PLAGUED with continuous trouble on our 250-psig boilers using 210-F feedwater. The internal feed pipes were always loosening up and leaking. They were threaded into the underside of the flanged feed-connection saddle. At first we tried to correct the trouble by using oversize threads and various arrangements of supports. None of these cured the chronic condition. We finally solved the problem by redesigning the connection as shown in the sketch.

We first checked local boiler regulations on the required strength of the saddle. Comparing with our saddle, we found they allowed us to bore out the saddle so there was a 0.004-in. clearance for the inserted feed pipe. The latter consisted of a machined pipe with flange welded at one end. The pipe was coated with a "hot-wet" internal boiler paint and inserted into the saddle. The pipe flange rests on the saddle flange. We installed gaskets between the flanges before tightening up the joint. The pipe was machined just enough to insure its roundness and not enough to interfere with the threads on the lower end. This setup has been completely successful.

J A SWANSON *Princeton, B.C.*

SETTLING BOX REDUCES LABOR, PREVENTS PUMP OVERLOAD

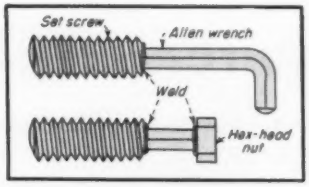


SLUDGE ACCUMULATIONS in sump pit, serviced by a vertical pump, overloaded the driving motor. In addition, more time was needed to clear the pit of fluid. This trouble was compounded by the suspended calcium hydroxide carbonating into hard cakes. A good deal of time and hard labor was needed to clear out these deposits to make the sump pit usable again.

In studying the condition we found that the entrained solids, running about 17%, settled out fairly quickly. All that the liquid needed was a place where it could drop its sludge load before being pumped to waste from the sump pit. To save time and money the separated sludge should be easily removable. To meet these requirements we built a weir box between the pit and inlet pipe as shown in the sketch. The box was rather shallow and at grade level so it could easily be shoveled clean of sludge. Operation of this layout has proved its practicality.

J D CONSTANCE *Cliffside Park, N.J.*

HOW WE DEALT WITH STICKING HOLLOW-HEAD SETSCREWS



DURING OUR ANNUAL INSPECTION of a 1500-kw steam turbine we came across several hollow-head setscrews that wouldn't budge. We inserted Allen wrenches into the screw hole and after applying full force, the wrench would round off. After considerable sweating and cussing we finally hit upon the idea of carefully welding the wrench to the setscrew, as shown in the sketch. This solved the problem and made it easy to remove the screws without having the wrench fail. In a few places we cut off the end of the wrench after welding it in place, and welded a nut on the cutoff end. This allowed using a monkey wrench for greater force.

D E SIBERT JR *Memphis, Tenn.*

WE SET UP TRANSITS WITHOUT MARRING FINISHED FLOORS

WHEN SETTING UP heavy equipment we use a transit to insure perfect alignment before grouting. Where floors are rough, setting up a transit is easy. But where tile, linoleum and terrazzo are in place, the transit-tripod spikes leave an ugly mar. We have enormous areas of highly waxed concrete, which compounded our problem. We were stymied until a janitor suggested using linen bags filled with lead shot. These worked perfectly. The bags are clean, weigh about 20 lb filled, and are easily handled. One bag is draped about each transit leg holding it perfectly steady. For marking out the floor we used glass-writing wax crayon, which is easily removed.

Along the same line, when working outdoors on macadam or asphalt we use round tin washers for marking—the kind that fasten down tar paper. A 40-penny nail holds the marker in place. The bright sheen attracts the eye making identification easy. These markers last a long time.

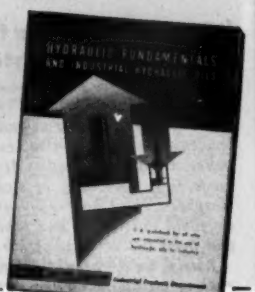
P C ZIEMKE *Oak Ridge, Tenn.*

NEW SUN PRODUCT CLEANS HYDRAULIC SYSTEMS Without Downtime!

SUN'S NEW HYDRAULIC SYSTEM CLEANER eliminates the production loss and man-hour loss that usually go with the cleaning of equipment. This product does its work *without interrupting production*. It has the detergency to remove the sludges and gums formed by oxidation of hydraulic oil, soaps formed from coolants and cutting oils, and other contaminants. Besides permitting operations to go on undisturbed, it protects the system against further rusting once parts have been cleaned. Sun Hydraulic System Cleaner has been thoroughly "Job Proved" in cleaning up hydraulic systems of presses, machine tools, and circulating systems of a great variety of industrial equipment. It is available in viscosities suitable for any pump. Get peak performance out of *your* equipment by using Sun Hydraulic System Cleaner.

FREE!

to anyone who uses or maintains hydraulic equipment: this booklet by Sun Engineers on the fundamentals of hydraulic systems and the application of hydraulic oils. It will prove valuable as a guidebook in day-to-day work, a refresher course for engineers, or a readable instruction book for nonprofessionals.



Sun Oil Company
Dept. P-2
Philadelphia 3, Pa.

☐ I should like a copy of **"Hydraulic Fundamentals and Industrial Hydraulic Oils."**

☐ I want more information about **Sun Hydraulic System Cleaner.**

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SUN OIL COMPANY, PHILADELPHIA 3, PA. • SUN OIL COMPANY, LTD., TORONTO AND MONTREAL

SUNOCO®

PROBLEMS FROM THE PLANT

THIS MONTH'S QUESTION:

Should We Open Pumps Regularly for Inspection?

In two recent POWER articles on centrifugal pumps, manufacturers' engineers advise readers not to open pumps for inspection as long as they operate satisfactorily. This does not check with our experience and practice.

We regularly open our pumps for inspection, checking of clearances, cleaning and repairs. This gives far better results than when they are allowed to run until performance starts to fall off or a telltale sound of trouble is heard.

No doubt other POWER readers have ideas on the subject. So we'd like to get their thinking on these questions: Should centrifugal boiler feed, water service, sump and similar pumps be opened regularly for inspection? If so, at what intervals? What should we look for after pump is opened? Have readers any methods that speed tearing down and rebuilding? Or should the pump run until it shows signs of trouble before being opened?

We'd appreciate sketches and photos that help bring out experience in this type of maintenance.—*JRB*

Exercise your engineering wits by submitting answers to this question, fresh from the plant. Suitable material will be paid for; answers with sketches or photos command extra pay

Readers Answer the November Question

What Kind of Alarm for Process-Steam Wastage?

(This question from the November issue is followed by best answers from readers.)

WE HAVE SEVERAL ENGINES *and two noncondensing turbines that exhaust to power and process loads. At times we waste large quantities of steam to atmosphere. If we had sufficient warning we could shift power and process loads and avoid all or most of our wastage.*

Lately we've been thinking of installing an alarm on the atmospheric-relief valve. This would ring or light up when valve opened. Now one of the gang is suggesting use of a recording flowmeter with an orifice in the relief line. I think we could use an orifice plate and a manometer.

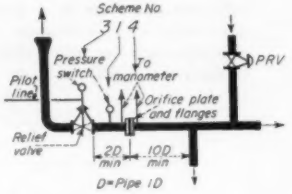
Here's the problem. Have any POWER *readers ever used one of these setups? If so, how was it built, where was it hooked into the line, and how was it calibrated, if at all? We need sketches and reasons for using a particular method. Also, how much would it cost?—G H*

Warn Operator

PROBLEM OF PREVENTING process-steam wastage is one of warning operator in time to prevent the opening of atmospheric relief valve. *GH* should install a pressure switch in 50-psi header and hook it into a bell or light circuit to give alarm.

Pressure switch may be installed in any convenient location in header and is easily screwed in place like a pressure gage. Set to operate at a pressure slightly less than relieving pressure of relief valve. Cost is low.

W H CHENAULT *Atlanta, Ga.*



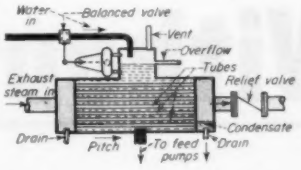
Four Schemes

ALARM HOOKUP can be worked out in several ways. Most satisfactory and cheapest scheme is installation of a pressure switch close to valve but ahead of it. Switch closes alarm circuit slightly below pressure at which relief valve opens. This gives warning of impending steam wastage and steps can be taken to prevent it. Pressure range of about 2 psig between prv makeup closing and relief-valve opening is needed for switch operation.

Or use microswitch operated by valve movement. Switch closes when valve starts to open. If relief valve is air or steam operated, a pressure switch can be installed on pilot line and connected to alarm. This gives advance warning of valve movement but can't be used on spring-loaded relief valves.

Use orifice plate to meter waste steam, as in sketch. Differential across orifice can be read with a manometer or recorded on standard steam flowmeter. I suggest that *GH* call in a flowmeter engineer for this job. Alarm can be used with this arrangement, if desired.

J C PORTER *Rock Hill, S.C.*



Don't Waste Steam

PUT WASTE STEAM to work and reduce fuel bill by heating feedwater for boilers and hot water for plant use. Firetube boiler serves as good water heater. Or a large tank fitted with tubes can be used. Run steam through tubes to obtain maximum distribution. Water surrounds tubes, see sketch, and flow into heater is controlled by float valve and vent.

Heater must be installed ahead of relief valve so if heating surface is insufficient, relief valve can still pass steam to atmosphere. Be sure to provide sufficient head on feed pump to prevent flashing of hot feedwater.

If atmospheric relief is too far away to be heard, tap ¾-in. line into exhaust line and run the small pipe to engine room. Here connect to a low-pressure whistle. When whistle sounds it will command attention. Never blow Btu's to the clouds. It doesn't pay.

VINCENT STROJSA *Glace Bay, N.S.*

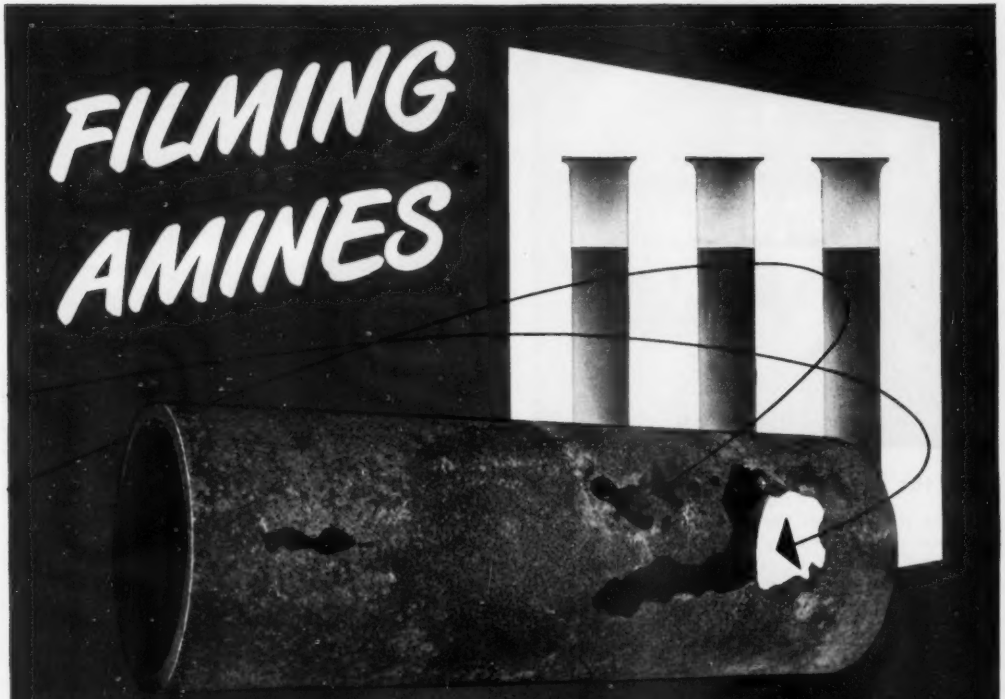
Mercury Switch Suitable

PUT MERCURY SWITCH in exhaust line. Set it for same pressure as atmospheric-relief valve is set to open. Connect switch to bell or light, or both. We now use mercury switches to actuate the motor-operated valves for makeup from our 250- to 50-psi lines. They are placed ahead of a reducing valve set for 50 psi.

D E SIBERT, JR *Memphis, Tenn.*

For more plant problems, turn page

FILMING AMINES



Prevent Return Line Corrosion

Send for Betz Technical Paper #121, "How Filming Amines Prevent Steam and Return Line Corrosion."

CORROSION of steam and condensate return lines is a serious problem to most industrial plants. Such corrosion is caused by the presence of carbon dioxide and oxygen. Up to now, it has been the usual practice to neutralize the carbon dioxide. However, the high cost of this neutralization method has limited its application. And, no protection against oxygen corrosion is assured.

Betz Laboratories have developed a new advanced process for the prevention of return line corrosion employing *octadecylamine.* This material *does not* neutralize the carbon dioxide. Instead, the amine is adsorbed on the metal surface in a monomolecular non-wettable film which acts as a barrier between the metal and the condensate, protecting against both oxygen and carbon dioxide attack. The monomolecular film does not increase in thickness with continued treatment.

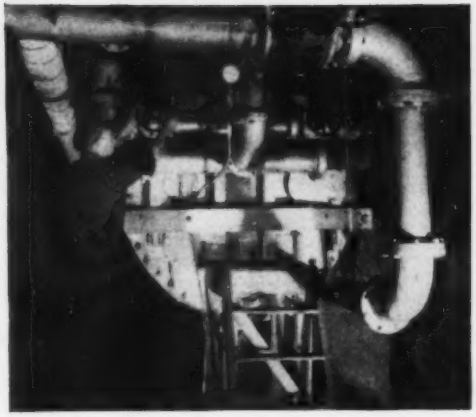
Results? As high as 99 per cent reduction in corrosion rate has been achieved. Maintenance and replacement costs on return line systems have been reduced to negligible amounts.

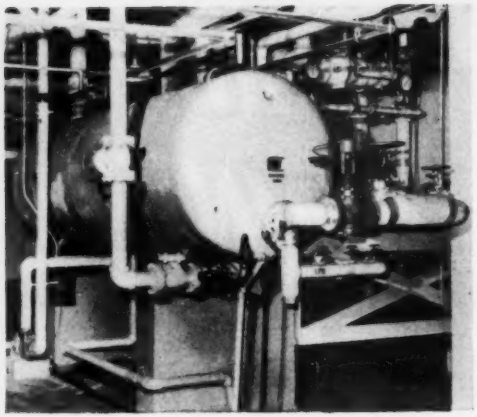
Let a Betz Field Engineer show how you can cut costs in your plant with the use of filming amines. Write today! There's no obligation of course. W. H. & L. D. BETZ, Gillingham and Worth Streets, Philadelphia 24, Pa. In Canada: BETZ Laboratories, Limited, Montreal 1.

*U.S. PATENT 2,460,259
CANADIAN PATENT 461,238

BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

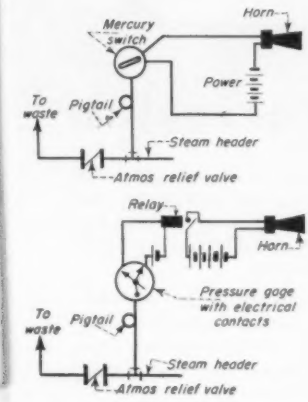




Save the Steam

I've seen many plants where waste steam was rerouted to water heating, process and other uses. Recently, in a paper mill I saw an old hrt boiler that had been converted to a water heater, left photo. Water to be heated flows through the tubes, steam around their outside. Of course, the setup was inspected. I've also seen standard storage-type hot-water heaters that had a connection to atmospheric relief line. They took steam from this line whenever there was an excess. Check valve prevented back flow from normal supply line.

D T Kelland *New York, N.Y.*



Alarms Work for Him

Warning equipment in sketches is cheap and simple. In upper sketch, mercury switch is connected to steam header. When circuit closes within switch a horn or light warns operator. Limit of switch can be adjusted to 10 or 15 psi below relief-valve opening pressure.

Use pressure gage with "setting" pointer for hookup in second sketch. Preset at 10 to 15 psi below relief-valve setting. When pressure-indicator pointer passes over "setting" pointer, contact is made and circuit closed. For this arrangement a relay is needed because permissible current is low.

Mount mercury switch or pressure gage near valve or remote from it, depending on plant setup. Protect switch and gage with a pigtail in tubing.

We've used the mercury-switch idea in many of our power plants for steam and water services. The systems have always worked well.

A J Breugelmans *New York, N.Y.*

Alarm Is Good

Alarm attached to atmospheric relief valve is a practical and inexpensive way of warning plant personnel that excess steam is available. To have sufficient warning while exhaust pressure is rising and before relief valve begins to open, it would be better to install pressure switch in 50-psi line and connect it to an alarm. Set switch to sound alarm 5 to 10 psi lower than relief-valve opening pressure to give sufficient time to shift power and process loads without wasting steam. Alarm switch can be remotely located from 50-psi line by connecting switch and pipe tap in line with tubing. Or connect switch and pigtail directly to line pipe tap.

Use of orifice plate and manometer is not practical.

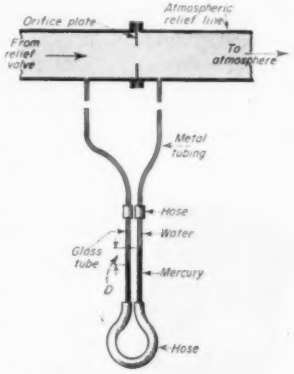
I L Meyer *Philadelphia, Pa.*

Recording Flowmeter Good

Recording flowmeter is best device to ascertain flow to atmosphere and obtain better heat balance. Estimate maximum flow and have manufacturer build and install the complete job as well as furnish instructions. Mercury switch mounted on a moving linkage in meter can be connected to alarm.

Manometer gives spot check on flow. Use an electric eye on manometer to ring an alarm. Or put a switch on a moving part of the relief valve.

Melvin Evans *Chicago, Ill.*



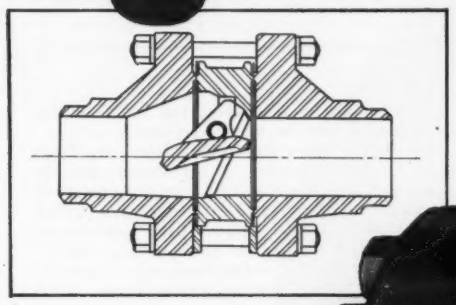
Use Manometer

Mercury manometer on atmospheric-relief line costs little and gives useful measure of steam going to waste. Measurement is rough but suitable for usual plants.

(*Continued on page* 166)

FOR HIGHER PRESSURES

3 Piece Tilting-Disc Check Valve



Has Removable Center Section for Quick and Easy Replacement of Operating Parts

Here's a Tilting-Disc Check Valve designed specifically for higher pressures. Its construction permits replacement of operating parts, if ever necessary, without removal of entire valve from the line. Once the studs between inlet and outlet sections of the body are taken out, the entire center section (containing disc, seating face and hinge pins) can be removed. Replacement of center section is fast, easy — an important advantage.

Important, too, is the smooth, easy operation obtained by the tilting-disc design. The balanced disc is held on the open stops by the velocity of the medium being handled. There's no slamming on closure to cause destructive pipe line stresses.

Write for complete description.

STANDARD 2-PIECE TILTING-DISC CHECK VALVES are available in either iron or steel for all pressures.

The Chapman Valve Mfg. Co.
INDIAN ORCHARD, MASSACHUSETTS

TECHNICAL BRIEFS

ENGINEERING DEVELOPMENTS HERE AND ABROAD DIGESTED FOR BUSY POWER MEN

REVIEWED IN THIS ISSUE

LUBRICATION: Some Industrial Experience With Synthetic Lubrications • Properties and Performance of Silicone Lubricants • Dry Lubricants

PIPES AND FITTINGS: Effect of Internal Pressure on Bolted-Flanged Connections • Formula for Pipe Thickness • Nickel-Chromium-Molybdenum Steel Valve Casting • An Investigation of the Role of Aluminum

FUELS AND FIRING: Operating Problems Encountered in Burning Heavy Fuel Oil • A Survey of Difficulties in Burning Heavy Oils • Experience With Attack in High-Temperature Zones • Vanadium Attacks at High and Low Temperatures

AIR CONDITIONING: Heat Transfer Coefficients in Horizontal-Tube Evaporators • Ultraviolet Air Disinfection in Room Air Conditioners • Absorption Air Conditioner • A Survey of Heat Pump Research and Development

WELDING: Development of Welding Procedures for High-Pressure High-Temperature Piping • Welding High-Pressure High-Temperature Piping

Directions for ordering papers are given on page 130

Lubrication

SOME INDUSTRIAL EXPERIENCE WITH SYNTHETIC LUBRICANTS, *by C H Sweatt and T W Langer, Union Carbide and Carbon Corp.* The authors grant that conventional petroleum lubricants give satisfactory service in the majority of industrial applications. However petroleum products do possess recognizable limitations under certain operating conditions. Hence the field for synthetic lubricants centers about their unique and superior performance characteristics compared to petroleum products *in specified applications.*

Several types of synthetic lubricants are now available. But the fluids discussed in this paper are only the polyalkylene glycols and their derivatives. These lubricants range in viscosity from very light to highly viscous liquids.

Some of the unusual properties of the polyalkylene glycols include excellent antiwear action, good load-carrying capacity, favorable viscosity-temperature relationships, low stable pour points, stability at elevated temperatures.

The paper includes a number of specific and practical experiences under different operating conditions. Among these are high-temperature use for kiln cars, gears, metal working, compressor and vacuum-pump applications. *ASME paper No. 50-A-139.*

PROPERTIES AND PERFORMANCE OF SILICONE LUBRICANTS, *by G Grant III and C C Currie of Dow Corning Corp.* This summary of the physical properties and performance of the silicone lubricants makes a good running mate to the above abstract covering the polyalkylene glycols. Once again the authors describe the characteristics of each available silicone lubricant along with typical applications.

Note that test results show silicone fluids and greases have good lubricating qualities in antifriction bearings. But where sliding friction between ferrous surfaces is involved silicone fluids and greases are unsatisfactory both under heavy loads and where boundary lubrication is required. However, in some cases involving sliding friction under light loads, silicone lubricants have been used successfully in steel against steel bearing surfaces.

From an over-all point of view we may say the silicone lubricants show good resistance to heat and many corrosive materials. They show but little change in physical characteristics over a wide temperature span. Load-carrying capacity may be good or limited depending on the bearing metal combinations.

Silicone lubricants are most useful where organic oils and greases stiffen at low temperature, break down in corrosive atmospheres, bleed, evaporate, or form gums at high temperature. *ASME paper No. 50-A-144.*

DRY LUBRICANTS, *by Alfred Sonntag of Alpha Corp and Alden Crankshaw of Acheson Colloids Corp.* In this combined discussion on dry lubricants, Sonntag reported on the properties and applications of molybdenum disulfide while Crankshaw spoke on graphite as a lubricant.

Molybdenum Disulfide. This substance will probably never compete with any petroleum lubricant *that is now doing a satisfactory job.* First off, it's relatively expensive. Its main field appears to be where lube problems still exist when conventional lubricants are used.

Molybdenum disulfide is a chemical combination of molybdenum and sulfur. It resembles graphite in appearance. But it can be easily distinguished by its weight. It is twice as heavy as graphite and has about five times its specific gravity.

Some years back a lubricating bonding coating of molybdenum disulfide was developed using an equal weight of corn sirup. This mixture was painted on metal surfaces. Later tests show it will stand up under at least 650 F. And the coating bonds well on stainless steel, aluminum, brass and copper.

Colloidal Graphite. One highly successful application is the lubrication of dies. Here a petroleum solvent dispersion of colloidal graphite is often used. In some applications the die is coated at intervals and the work is coated as each piece comes through the press. Still another application—the extrusion of aluminum tubing—calls for a water dispersion of colloidal graphite.

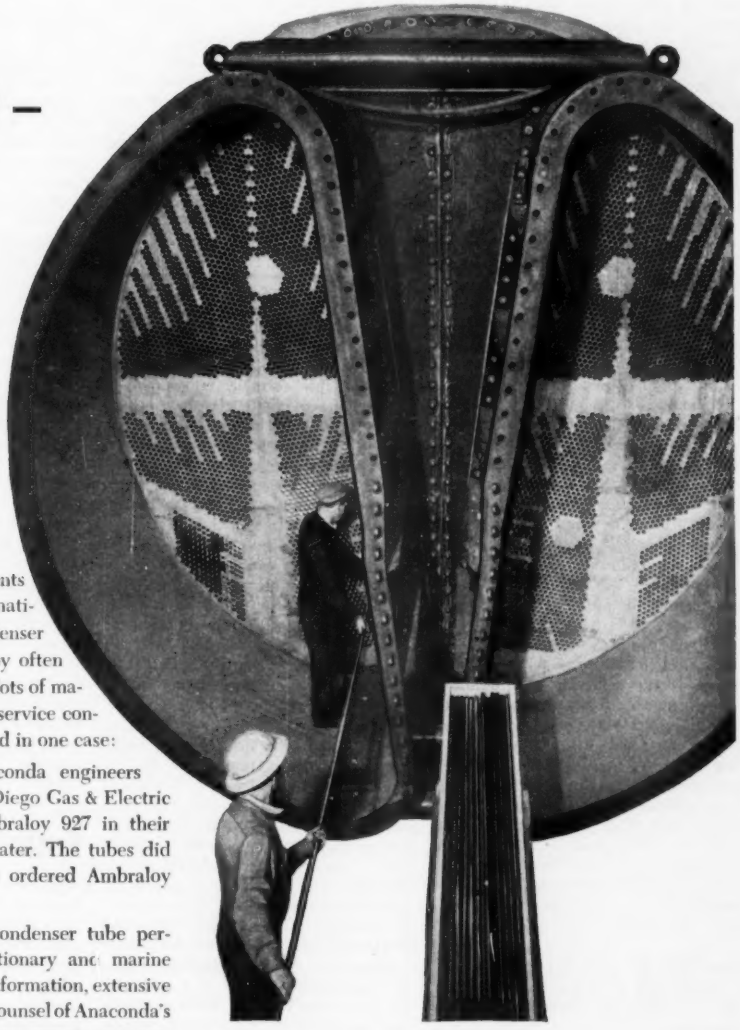
An important and basic thought stressed by the author is that *it's the graphite film that does the lubricating job.* The accompanying liquid is merely a carrier used to put the graphite where it is needed. And the choice of liquid is often determined by the temperature of the application. For instance, you can use a water dispersion for die coating at 500 F. But for an oven-conveyor job running 1050 F, a water dispersion will evaporate off before the graphite has reached its mark. Presented before New York chapter, American Society of Lubricating Engineers. No copies available.

Pipes and Fitting

EFFECT OF INTERNAL PRESSURE ON STRESS AND STRAINS IN BOLTED-FLANGED CONNECTIONS, *by D B Westrom and S E Bergh, E I du Pont de Nemours & Co, Inc.* About 15 years ago a set of rules for the design of bolted-flanged connections was added to the *ASME Unfired Pressure Vessel Code.* The rules were revised in 1938 to include

how to be right – 6,100 times!

INSTALLING 6,100 TUBES *of Ambraloy 927 in the No. 3 condenser of the Silver Gate Plant of the San Diego Gas & Electric Company, San Diego, Calif. This Worthington Condenser serves a 50,000 kw. General Electric Turbo-Generator. It has 38,000 sq. ft. of condenser surface and can handle 620,000 lb. of steam per hour.*



Many power plant requirements can be supplied with mathematical precision. But not condenser tubes. To pick the right alloy often takes lots of experience with lots of materials under many different service conditions. Here's what happened in one case:

Thirteen years ago, Anaconda engineers recommended that the San Diego Gas & Electric Company use tubes of Ambraloy 927 in their condensers cooled by salt water. The tubes did so well that this utility has ordered Ambraloy 927 for other installations.

We have a vast file of condenser tube performance data on both stationary and marine installations. This wealth of information, extensive laboratory facilities and the counsel of Anaconda's Technical Department engineers are at your service. Call us any time, and meanwhile make sure Anaconda Publication B-2 is in your files. Write The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 50120

for efficient heat transfer

ANACONDA® CONDENSER TUBES

the general case where a tapered transition is provided between shell, pipe or nozzle neck, and ring portion of the flange. Except for minor revisions they have remained in the same form.

Use of Code rules has resulted in satisfactory designs in the vast majority of applications. This has been particularly so where conventional types and arrangements of flanges, bolting and gasketing have been employed, where sizes, pressures and temperature conditions have been moderate, and where conservative values were adopted for gasket factors. But there have been a number of recent experiences in which bolted-flanged joints could not be made tight. Designs in question were characterized by large diameters or high pressures, or both, that led designers to take maximum advantage of design values permitted by the Code to keep dimensions and weights at a minimum. Sometimes, also, effects of temperature played an important part. Analysis of the designs by methods presented in this paper indicated that in these instances, at least, design conditions were beyond the range within which Code rules could be used successfully.

Difficulties encountered should not be considered entirely the fault of the rules. They give only minimum requirements for safety and theoretically their task stops there. Leakage of highly toxic or flammable contents is not likely to occur if joint has successfully withstood prescribed hydrostatic test. Unless temperature or corrosion conditions in service are unusual, hydrostatic test should be proof of adequacy of design.

No recorded instance is known of sudden and total failure of a flanged joint where ductile materials were used. In fact, components of a flanged joint may be regarded as very stiff springs comprising a sort of safety relief valve, that "opens" (leaks) when pressure reaches a certain value. It is shown that Code rules are merely a rational method of arriving at a balanced design in which the bolts, flanges and gaskets are in proper proportion to one another with respect to a stress of some undetermined level. *ASME paper No. 50-A-51.*

FORMULA FOR PIPE THICKNESS, *by W J Buxton and W R Burrows, Standard Oil Co (Indiana).* This paper covers formula studies of pipe thickness and represents part of the work of the current revision being made of ASA B31, Code for Pressure Piping. Significance of formulas for design purposes is explained and their relationship to the so-called Lamé formula is demonstrated.

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from one of the following sources or is specifically identified at the end of each abstract:

American Society of Mechanical Engineers, annual meeting, New York, N. Y. Nov 26-Dec 1, 1950. Papers are identified by initials ASME. Obtainable from ASME, 29 W 39th St, New York 18, N. Y.

American Welding Society, annual meeting, Chicago, Ill. Oct 22-27, 1950. Papers are identified by initials AWS. Obtainable through AWS, 29 W 39th St, New York 18, N. Y.

American Society of Refrigerating Engineers, annual meeting, New York, N. Y. Dec 3-6, 1950. Papers are identified by initials ASRE. Obtainable from ASRE, 40 W 40th St, New York 18, N. Y.

The Lamé formula, either in its true form, or in an equivalent but less complex modified form, is advanced as the most suitable formula for design of pipes stressed in the elastic range by internal pressure. In creep range, use of the Bailey-Nadai formula is proposed. The paper shows that the so-called Lamé formula in either form is a good approximation of the Bailey-Nadai formula. In selection of the two formulas (Lamé and Bailey-Nadai) an examination was made of the Common, Average (Membrane), Barlow, Clavarino, Guest, Beltrami, and von Mises formulas. Need for additional pure shear experimental data on creep and on stress rupture is emphasized. Tables and charts summarize comparisons. *ASME paper No. 50-A-62.*

NICKEL-CHROMIUM-MOLYBDENUM STEEL VALVE CASTING AFTER 50,000 HR. OF SERVICE AT 900 F, *by T N Armstrong and R J Green, International Nickel Co, Inc.* Extensive tests indicate that nickel-chromium-molybdenum steel, conforming to requirements of ASTM Specifications A-217, is very resistant to graphitization under conditions imposed in laboratory tests of cast valves and fittings of this composition for steam temperatures up to 950 F. Detroit Edison Co permitted study of a cast-steel valve of approximately WC-4 composition that had been in continuous service over six years.

Study showed there had been no loss of strength, no embrittlement and no occurrence of graphite in the welded valve casting of nickel-chromium-molybdenum steel after exposure to steam at 900 F nominal temperature for 53,810 hr. It was estimated valve operated 90% of the time at temperatures in the 885 to 900 F range. Maximum temperature was 935 F, minimum 855 F. *ASME paper No. 50-A-67.*

AN INVESTIGATION OF THE ROLE OF ALUMINUM IN THE GRAPHITIZATION OF PLAIN-CARBON STEEL, *by A M Hall and E E Fletcher, Battelle Memorial Institute.* Investigation was sponsored by Project No. 29 of the Joint ASTM-ASME Committee on the Effect of Temperature on Properties of Metals. It was directed toward casting more light on the role of aluminum in the breakdown of iron carbide in plain-carbon steels into iron and graphite at temperatures below the lower critical point of the steel.

Approach to problem was to extract carbides from several plain-carbon steels, which had been deoxidized with different amounts of aluminum and had different known degrees of susceptibility to graphitization. Extracted carbides were examined and analyzed with particular attention to amount and form of aluminum present. By comparing the aluminum found in the carbide with aluminum of the original steel, data were obtained on the role that element appears to play on the graphitization process.

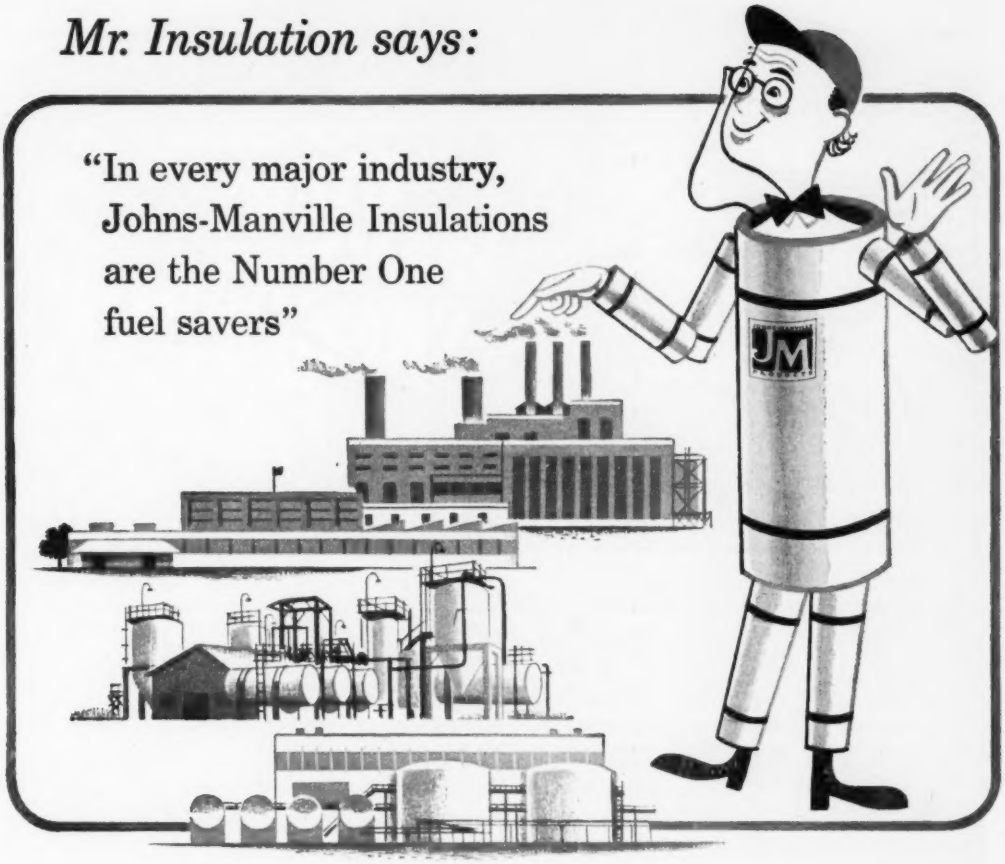
Results strongly suggest that a graphitization-resistant, plain-carbon steel does not differ fundamentally from one that graphitizes readily. It is tentatively concluded that to promote graphitization, aluminum is either in solid solution in the ferrite matrix, or else fixes the nitrogen as AlN. Which of these forms it takes could not be determined from the results. Results further suggested that any aluminum that might be associated with the carbide phase is not influential in determining the degree of susceptibility to graphite formation. *ASME paper No. 50-A-69.*

Fuels and Firing

OPERATING PROBLEMS ENCOUNTERED IN BURNING HEAVY FUEL OIL AS RELATED TO ATTACK ON METALS, *by V F Estcourt, Pacific Gas & Electric Co.* Problems with the poorer grades of fuel oils are related to both chemical and physical characteristics such as fusion temperature, percentage of ash and sulfur, and certain specific constituents in the ash, particularly sodium, vanadium and nickel.

Because of the relatively low fusion temperature of the ash in fuel oil compared to coal, slag deposits concentrate in the superheater rather than on

Mr. Insulation says:



IN PLANTS with stacks or stills, tanks or towers, the story is the same—"Insulation by Johns-Manville" means the maximum return on your investment. There are two good reasons for this:

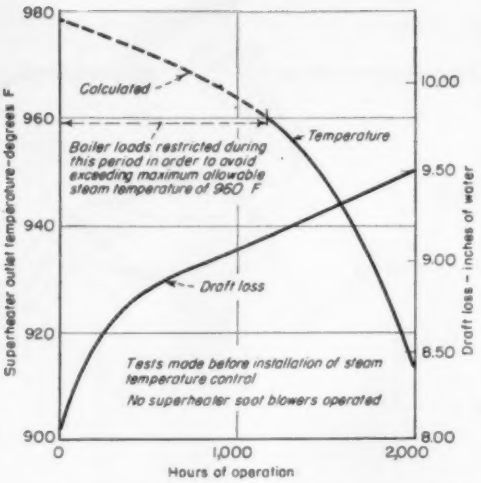
1. YOU GET THE RIGHT *MATERIALS*—From asbestos and other selected raw materials, Johns-Manville manufactures a wide range of industrial insulations for service from 400F below zero to 3000F above. If you need engineering advice in determining exactly the right one for your job, you can get experienced and authoritative assistance from your local Johns-Manville insulation engineer.

2. YOU GET THE RIGHT *APPLICATION*—Even correctly selected insulation needs proper application to permit it to serve at peak efficiency through the years. Here you can always count on J-M Insulation Contractors and their highly skilled mechanics. These organizations are trained in Johns-Manville application methods, and have generations of insulation experience behind them.

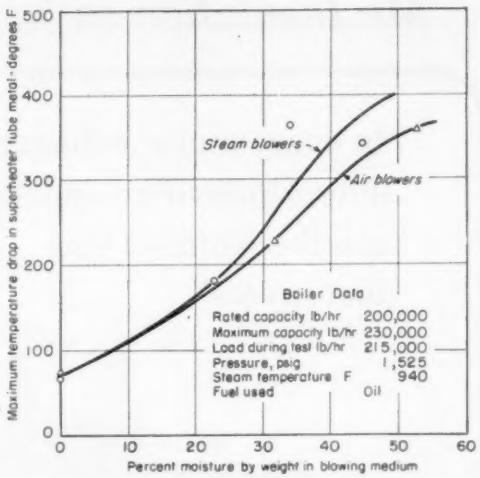
Why not get the complete picture? Call on insulation headquarters when your next job is in the planning stage. Just write Johns-Manville, Box 290, New York 16, N. Y.

JM PRODUCTS

Johns-Manville *first in* **INSULATIONS**



1 Fuel-oil slag deposits concentrate in superheater bank, cut down on outlet temperature and increase draft loss



2 Water added to soot blower helps greatly in removing slag; temperature shock to superheater metal can be controlled

screen tubes and are difficult to remove with soot blowers. Deposits in the back end of the superheater and in most of the economizer are usually softer and can be removed by proper application of a retractable-type soot blower. In the air heater where gas temperatures are below dew point, sulfur content in the fuel oil directly affects fouling and corrosion problems if sulfur content is above 1½ or 2%. Actual wasting away of the metal is also accompanied by accumulation of corrosion deposits, so both fouling and corrosion proceed hand in hand with the higher sulfur content and formation of SO_3 in the products of combustion. It is generally accepted that the dew point is substantially raised, precipitating weak acids and heating surfaces at temperatures as high as 350 to 400 F.

Slag accumulations on boiler heating surfaces increase resistance to the flow of gas and eventually reduce boiler output as soon as reserve capacity of fans is used up. If deposits are severe and cannot be removed, there is a gradual decrease in temperature of superheated steam, which results in loss in turbine cycle efficiency. Fig. 1 illustrates what happens to superheater outlet temperature and draft loss when tube bank fouls up with no soot-blower action.

By adding relatively small percentages of water to the normal blowing medium of either steam or air, it is possible to obtain (1) higher impact velocity of jets leaving soot blowers and (2) the desired cleaning with less temperature shock to tube metal than is possible with straight water lancing, Fig. 2. Degree of temperature shock can be completely controlled by merely varying percentage of water added to blower. Soot-blower effectiveness was obtained by adding as little as 15 or 20% of water by weight, and maximum temperature shock was only about 140 F, considered quite moderate. *ASME paper, No. 50-A-136.*

A Survey of Difficulties Encountered in Burning Heavy Residual Fuel Oils, *by E F Tibbetts, The Lummus Co.* A few years ago, shortly after the joint ASME-ASTM Committee on Effective Temperature on Properties of Metals was reorganized, the newly formed Petroleum and Chemical Panel made a number of surveys. They concerned difficult problems in application of metals on which there was limited reported information or widely differing opinions. One was the problem of corrosion of metals by oil ash in furnaces and boilers.

A letter survey of the petroleum and chemical industry and, to a partial extent, of the power industry has been made to determine to what extent, and under what conditions, corrosion and slagging of furnaces and boilers has been encountered in firing heavy residual fuel oils.

Although very little had been published on the subject, severe corrosion had been reported in a number of plants where vanadium-bearing fuels were fired. These reports indicated vanadium pentoxide, which was formed in the ash, vigorously attacked metals and alloys at temperatures above 1100 F. The rate of attack became progressively more severe at higher temperatures. In addition, it was believed presence of vanadium promoted sulfur attack at these elevated temperatures, and also acted as a catalyst in forming SO_3 from SO_2.

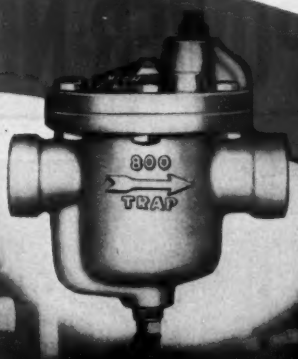
The author's report lists summaries of returns from the many companies answering a survey letter he sent out.

A number have reported slagging of superheater tube nests occurring primarily in internal superheaters of single furnace boilers operating at 600 psi and 900 to 1000 F superheat. The author referred to one highly interesting paper on the attack of vanadium-bearing oil ash on heat resistant steel by Paul Amgwerd, entitled, *Research on the Action of Oil Ash Containing Vanadium on Heat-Resistant Steels*, Schweizer, Anales Swisses, Vol 15, No. 10. *ASME paper, No. 50-A-136.*

Experience With Attack in High-Temperature Zone When Burning Heavy Fuel Oil Currently Available, *by D Douglass, Hartford Electric Light Co.* Within the past few years it has been generally recognized that there is a certain heavy corrosion attack due possibly to the effects of products of combustion coming off certain of the commercial bunker oils in the higher-temperature zones. Before 1942, the author's company had observed increased maintenance on cast chrome-nickel alloy supporting lugs for a horizontal superheater on the Ascoloy

(*Continued on page* 154)

A STEAM TRAP CASTS A MIGHTY BIG SHADOW!



● **LOAD ON BOILER CUT BY 75 HP** by trapping with Armstrongs, says Chief Engineer of large midwestern hospital.

● **30°-40° TEMPERATURE INCREASE** on 8-roll ironer after unit trapping with Armstrongs, reports large eastern laundry.

● **STARCH DRYER HEAT-UP TIME CUT 2-3 HOURS** after retrapping with Armstrongs, says Canadian plant engineer.

● **125 HP BOILER NOT NEEDED** — 80 HP boiler does the job since Armstrong traps were installed in a chemical plant in Iowa.

● **50% SAVINGS IN TRAP MAINTENANCE LABOR COSTS** since installing Armstrongs at midwest agriculture machinery plant.

● **COOKING KETTLE OUTPUT SPEEDED UP 30%** by Armstrong unit trapping at large canning plant.

. . . BIG EFFECTS from little traps! The "shadow" cast by a steam trap is multiplied in size by the number of traps in your plant until it grows to be a giant that you can't shrug off. Let your nearby Armstrong Representative show you how Armstrong Trapping can cut *your* fuel, production and maintenance costs. Call him today.

Write for STEAM TRAP BOOK —
36 pages of useful, how-to-do-it data. Free on request.

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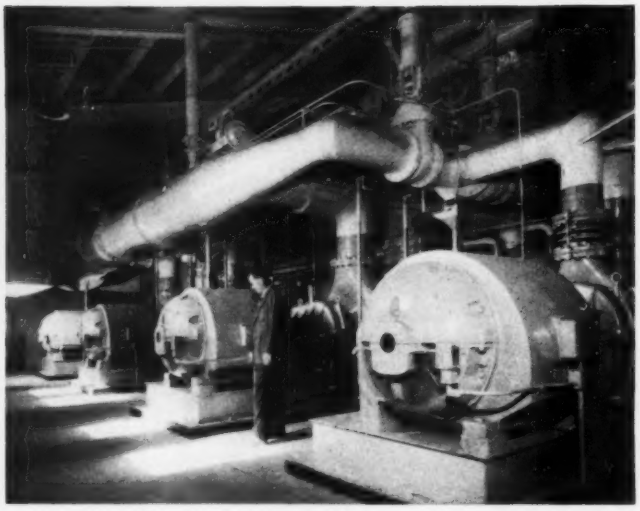
ARMSTRONG STEAM TRAPS

POWER NEWS

BUSINESS ITEMS • APPOINTMENTS • FOREIGN FIELDS
WASHINGTON NOTES • NEW DEVELOPMENTS • CONVENTIONS



High-Powered Compressors Serve Wind Tunnel

New hypersonic wind tunnel at the California Institute of Technology, Pasadena, Calif., is equipped with rotary-vane-type and double-acting reciprocating-type compressors capable of supplying air at 1000 psi. Most of the motors driving the compressors—two 150-hp, 600 rpm for eight compressors in tandem; one 200-hp, 600 rpm; one 75-hp, 600-rpm for two rotary compressors in tandem; and two 100-hp, 1180 rpm for two remaining units—are General Electric machines.

COMING EVENTS

March 5-9—American Society for Testing Materials. Spring meeting and committee week, Cincinnati, Ohio. ASTM, 1916 Race St, Philadelphia, Pa.

March 8-9—Prime Movers Committee of Pennsylvania Electric Assn, Berkshire Hotel, Reading Pa. E Gordon, Chairman, Potomac Edison Co, Hagerstown, Md.

March 13-16—National Assn of Corrosion Engineers, Conference and exhibition, Hotel Statler, New York, N. Y. L B Donovan, chairman, Consolidated Edison Co, 4 Irving Place, New York, N. Y.

March 15-17—American Society of Tool Engineers, national meeting, Hotel New Yorker, New York. Mr. Denham, 812 Book Bld, Detroit 26, Mich.

April 2-5—American Society of Mechanical Engineers. Spring meeting, Hotel Atlanta-Biltmore, Atlanta, Ga. O B Schier, ASME, New York 18.

April 2-6—Oil Heat Institute of America, 28th annual convention, Palmer House, Chicago, Ill. Mr Kaufman, secy, OHI, New York 16.

April 16-18—American Society of Lubricating Engineers. Annual meeting, Bellevue-Stratford Hotel, Philadelphia, Pa. W F Leonard, secy, ASLE, 343 S Dearborn St, Chicago, Ill.

Carbonizing Underground Coal Beds

Sinclair Coal Co and the Missouri School of Mines have been running a series of tests on effecting carbonization and then gasification of underground coal beds. The work, now in its third year, has been run in a coal seam, classed as Bevier by the U. S. Bureau of Mines, 2 ft thick with 23 ft of covering at the Tiger Washery of the Hume-Sinclair Coal Mining Co west of Hume, Bates County, Mo., 75 miles south of Kansas City, Mo.

Vertical 5½-in. holes are auger-drilled to the coal seam and lined with a steel pipe. A smaller hole about 3 in. dia drilled into the coal bed holds the pipe electrode very snugly. The electrode has a number of slotted openings to (1) promote the application of electricity to the coal bed (2) serve as a supply path for incoming air or an exit for gases withdrawn from the coal seam. A concrete plug 10-12 ft deep and about 7 ft dia seals the ground where each pipe emerges.

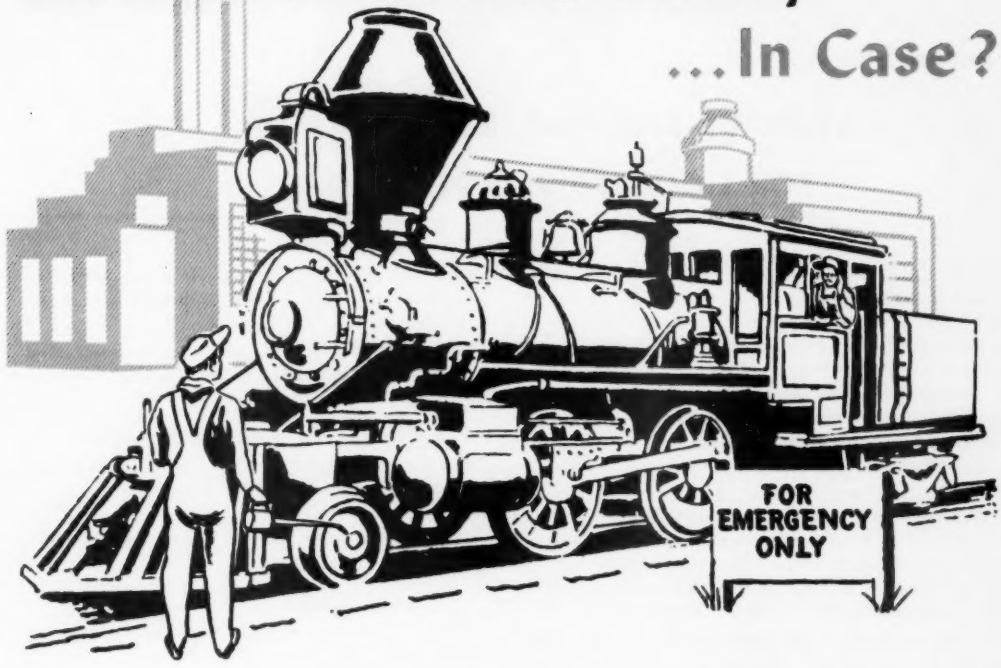
The latest test had four electrodes arranged in a straight line 30 feet apart giving a total distance of 90 ft. A 500-kva single-phase converter supplies a very high voltage at the start to establish a breakthrough. Resistivity drops rapidly and voltage is lowered accordingly to give a fairly constant power input. The desired current density is 3 to 4 amp per sq cm of electrode surface.

This electric current passing between the electrodes carbonizes the coal enough to cause shrinkage. In addition it provides the starting temperature and the shrinkage opens a passageway through which air can be led to form producer gas. A coal gas of 500 to 650 Btu per cu ft is given off. This gas also carries tar and other products. Gas makeup at a carbonizing temperature of 800-900 C runs about 15% methane and other hydrocarbons, 50% hydrogen, 15 to 18% carbon monoxide, 6 to 8% carbon dioxide and 4% hydrogen sulfide.

When a portable compressor was used as the air-supply source for the

(*Continued on page* 194)

Got a Locomotive Handy ...In Case?



EVERY so often a steam locomotive makes news by going to the rescue of a plant where the steam system gave out at a critical time.

This is one answer to continued steam production pending repairs... and undoubtedly an expensive one. Simplest—and most economical—is to use the Nalco System and eliminate the chances of boiler down time due to faulty water treatment.

Nalco chemicals and services aim at *water treatment results* from raw water intake to condensate hot well . . . And the thousands of plants now using the Nalco System testify to the accuracy of this aim during the past twenty-six years. Whether your plant is large or small; your water problems scale, corrosion, carry-over—or just plain high cost—unless you have a locomotive handy for emergencies, better check with Nalco today. No obligation... and an excellent chance for permanent water treatment security.

P.S. More steam locomotives use Nalco-treated water than any other kind . . . Perhaps the reason why locomotives *can* be of help in plant emergencies!

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Canadian inquiries should be addressed to
Alchem Limited, Burlington, Ontario, Canada

THE Nalco SYSTEM... Serving Industry through Practical Applied Science

JENKINS PRACTICAL PIPING LAYOUTS

51a

How to plan a

STORAGE AND VAPORIZER HOOKUP FOR LIQUEFIED PETROLEUM GAS

One of the newest industrial and domestic fuels, Liquefied Petroleum Gas (such as propane, butane) is liquefied at atmospheric temperatures by the application of moderate pressures. It is then shipped by tank car to central storage plants in areas where it will be consumed. Diagram shows piping and other equipment used in vaporizing and storing these gases.

Unloading the liquefied gas into storage tanks is facilitated by a liquid pump and vapor compressor. The compressor draws off the vapor from the tank and returns it to the tank car at a slightly higher pressure, which helps force out the remaining liquid. The liquid passes through a regulating valve, then through the vaporizer where heat, from either steam or hot water, converts it to vapor at the required rate.

This gaseous fuel is then piped through a pressure regulator which assures a constant pressure, and on to the gas distribution system or to a gas-air mix unit if required. Vaporizers are installed in duplicate to provide continuous service in case of breakdown. Safety relief valves are vented to the atmosphere. Fig. 507, the check valve recommended on the inlet end of the vaporizer acts as a relief valve when a higher pressure is reached in the vaporizer than in the storage tank.

Globe and Angle Valves on pressure lines are the new Jenkins Fig. Nos. 506 and 508, designed specifically for Liquefied Petroleum Gas service. These valves are fitted with Jenkins slip-on stay-on disc holder and a 936-A disc, particularly recommended for L.P.G. service. The crowned seat assures absolute tight closure with a minimum of closing effort. Lugs on the body ends permit a firm grip with wrench for repeated valve disassemblies and assemblies without damage.

Jenkins Globe, Angle, and Check Valves for L.P.G. service are approved by the Underwriters' Laboratories, Inc.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installations.

A CHOICE OF OVER 500 VALVES

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the Jenkins Catalog. *It's your best assurance of lowest cost in the long run.*

Reserve your copy of
NEW BOOK of PIPING LAYOUTS — NOS. 26 to 50

A new book of Jenkins Practical Piping Layouts — Nos. 26 to 50 — is in preparation. Mail coupon to get your copy when ready.

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San Francisco. Jenkins Bros., Ltd., Montreal.

Fig. 506
L. P. G.
BRONZE GLOBE VALVE
(for Liquefied Petroleum Gas Service)
Renewable Composition Disc
400 lbs.
Non-shock O.W.G.
at maximum temperatures of 150°F.

APPROVED BY UNDERWRITERS' LABORATORIES, INC.

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Reserve book of Piping Layouts — 26 to 50 for:

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CODE	QUAN.	FIG. NO.	JENKINS VALVES	SERVICE
A	4	270-U	Bronze L. P. G. Gate	Liquid Fill of Storage Tanks
B	2	270-U	Bronze L. P. G. Gate	Liquid Line to Vaporizers
C	4	270-U	Bronze L. P. G. Gate	Liquid Pressure Regulator Shut-off
D	2	506	Bronze L. P. G. Globe	Liquid Pressure Regulator By-Pass
E	2	507	Bronze L. P. G. Check	Vaporizer Pressure Release
F	4	270-U	Bronze L. P. G. Gate	Vapor Pressure Regulator Shut-off
G	2	506	Bronze L. P. G. Globe	Vapor Pressure Regulator By-Pass
H	4	506	Bronze L. P. G. Globe	Pressure Gage Control
J	4	506	Bronze L. P. G. Globe	Pressure Control Line Shut-off
K	2	270-U	Bronze L. P. G. Gate	Distribution System Shut-off
L	4	270-U	Bronze L. P. G. Gate	Vapor Return for Tank Car
M	1	507	Bronze L. P. G. Check	Prevent Vapor Backflow
N	2	507	Bronze L. P. G. Check	Prevent Liquid Backflow
O	2	47	Bronze Gate	Warm Water Supply
P	2	106-A	Bronze Globe	Cool Water Discharge
R	2	508	Bronze L. P. G. Angle	Liquid Fill of Storage Tanks
S	2	508	Bronze L. P. G. Angle	Liquid Line to Vaporizers
T	2	508	Bronze L. P. G. Angle	Vapor Return for Tank Car

VALVE RECOMMENDATIONS
For details and valves to suit varying conditions see Jenkins Catalog

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Diagram by Huxley Madeheim
Consulting Engineer

Illustrating the proved 3-point formula for trouble-free, time-defying hookups

A **Use the right type valve for the service**

B **Place valves correctly in the line**

C **Choose Jenkins for lifetime economy**

JENKINS VALVES

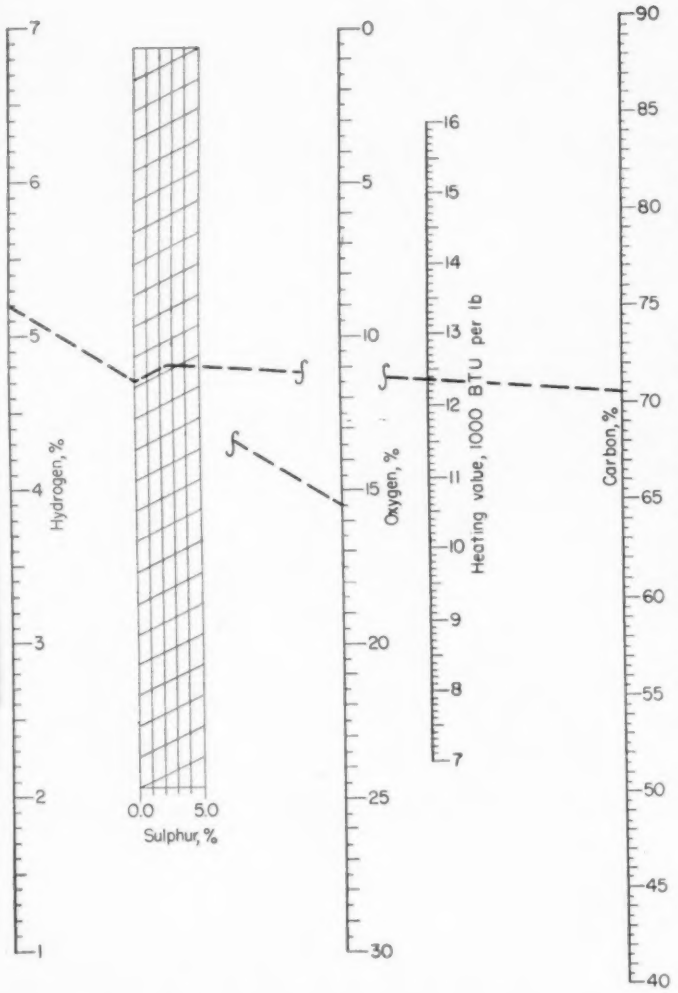
LOOK FOR THE DIAMOND MARK

SINCE 1864 TRADE JENKINS MARK

Jenkins Bros

Number 224

Coal-Heating Value From Ultimate Analysis



WHERE CALORIMETER measurements for coal-heating value are not available, the next best bet is to figure it from the coal's ultimate analysis. Standard method uses Dulong's equation, which is based on the heating value of each element:

Heating value, Btu per lb

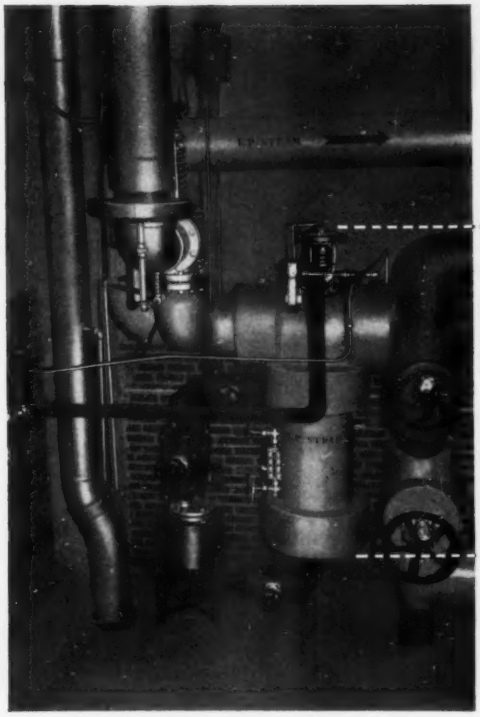
$$= 14{,}544C + 62{,}028\left(H - \frac{O}{8}\right) + 4050S$$

where C, H, O and S are the lb per lb of coal of each of the combustible elements.

Example: A coal with an ultimate analysis of 5.2% hydrogen, 15.5% oxygen, 70.5% carbon and 2.5% sulfur is being burned in a furnace. What is its heating value, if the remaining elements are moisture and ash?

Lay a straightedge connecting 5.2 on the H scale and 15.5 on the O_2 scale. From the intersection with the 0.0% S scale follow up parallel to the inclined lines to intersect with the 2.5% ordinate. From here lay a straightedge to connect to the 70.5 on the C scale. At the intersection with the *Heating Value* scale read 12,370 Btu per lb.

JOHN F HYAM *Sarnia, Ont.*



8-inch COPES Desuperheater installed for flows of up to 95,000 pounds per hour, to reduce steam temperature from 750 degrees F. to 475 degrees F. 175 psi.

TYPICAL LIST OF ORDERS
from
PUBLIC UTILITIES

Albuquerque Gas & Electric Co.
Central Illinois Electric & Gas Company
Dakota Public Service Company
The Delaware Power & Light Company
Edison Light & Power Company
Florida Power & Light Company
Interstate Power Company
Iowa Southern Utilities Company
Kansas Gas & Electric Company
Missouri Public Service Company
Missouri Utilities Company
Montana-Dakota Utilities Company
The Montana Power Company
New Jersey Power & Light Company
Northern States Power Company
Public Service Company of New Mexico
Public Service Company of Oklahoma
Raton Public Service Company
Utah Power & Light Company
Texas Electric Service Company

COPES
DESUPERHEATER
completely self-contained

costs LESS to install

With the temperature control element built into the mixing chamber, you need no long run of alloy steel piping in the steam line—no extra connections into this line—no long run of piping back from the temperature element to the desuperheater. With cooling water atomized inside the chamber, you need no extra steam atomizing valve and line with extra stop valves.

Installed and ready for round-the-clock service, a COPES Desuperheater offers you more than appears in the purchase price.

First of all, you'll find the installation simple and inexpensive, no matter what your piping layout.

You'll find operation and maintenance easy and low cost because of compact design, rugged construction.

You'll find the temperature control accurate, even on lightest flows, because cooling water is controlled and atomized inside the mixing chamber.

You'll find adjustments, if needed, simple and easily made by your plant personnel.

If you have a specific application in mind, write in detail about your requirements. If you want only general information, ask for Bulletin 405-C.

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Boiler Feed Water Control . . . Excess or Constant Pressure Control, Steam or Water . . . Liquid Level Control . . . Balanced Valves . . . Desuperheaters . . . Boiler Steam Temperature Control . . . Hi-Low Water Alarms.

ENGINEER'S BOOKSHELF

REVIEWED IN THIS ISSUE

PLANT ENGINEERING HANDBOOK • ELECTRICAL ENGINEERS HANDBOOK
CAPACITORS FOR INDUSTRY • GAS PRODUCERS AND BLAST FURNACES
SNOW MELTING • ASTM STANDARDS, PETROLEUM PRODUCTS, LUBRICANTS
POWER-SYSTEM STABILITY • MANUAL OF INSTRUMENT TRANSFORMERS
COAL PREPARATION • BUILDING OPERATION AND MAINTENANCE
MODERN ARC-WELDING LESSONS • REFRIGERATION ENGINEERING
STEAM PLANT OPERATION • MECHANICAL ENGINEERING LABORATORY
MODERN AIR-CONDITIONING, HEATING AND VENTILATING • POWER
PROCESS-HEAT TRANSFER • MODERN REFRACTORY PRACTICE
ELECTRICAL TRANSMISSION AND DISTRIBUTION REFERENCE BOOK

Building Operation

BUILDING OPERATION & MAINTENANCE, *by C A March, asst to supt of building operation, Detroit Edison Co.* 384 *pp*, 6x9, *cloth*, $6. *McGrdw-Hill Book Co*, 330 *W* 42*nd St, New York* 18, *N. Y.*

Here is practical information for building managers, owners and engineers in the everyday operation and maintenance of loft and office buildings, apartment houses, hospitals, schools, etc. Detailed facts are grouped to help in all kinds of problems, from writing a lease to putting out a fire, from collecting a rent bill to maintaining a heating system, from making an office layout to getting better results and economy in painting and cleaning. Importance of city fire and building regulations is stressed and many safety precautions for boiler rooms, elevators and maintenance work are given.

Plumbing, heating ventilation, air conditioning, elevators, electricity, cleaning, cleaning materials, roofs and structural maintenance are a few of the subjects. Book covers latest synthetic detergents, new disinfectants, deodorants, exterminators and insecticides.

All power engineers who operate and maintain buildings as part of their job will find this book worthwhile. Many phases of building management previously unavailable are collected for easy reference.

Steam Plants

STEAM-PLANT OPERATION (*revised 2nd edition*), *by E B Woodruff, maintenance engineer, The Drackett Co, and H B Lammers, chairman and director of engrg, Coal Producers Committee for Smoke Abatement.* 543 *pp*, 6x9, *cloth*. $7. *McGraw-Hill Book Co*, 330 *W* 42*nd St, New York* 18, *N. Y.*

This well-known book has broadened its coverage to include recent equipment and operating procedures. Starting with boilers the book discusses their construction, fuels, combustion equipment, boiler accessories, boiler operation and maintenance, pumps, steam engines, steam turbines and power-plant auxiliaries. Each phase is completely discussed—starting with typical units and going through their operation and maintenance. Practical problems are solved without advanced mathematics. Following each chapter are questions typical of engineers' license examinations.

Power engineers and their assistants will find this an excellent reference book for efficient operation and maintenance of all usual power-plant equipment in both large and small stations. In addition, it's a valuable aid in preparing for license examinations.

Electrical Handbook

ELECTRICAL ENGINEERS HANDBOOK (*Electric Communications and Electronics*), *4th edition. By Harold Pender and Knox McIlwain.* 6x9, $8.50. *John Wiley and Sons Inc, 440 Fourth Avenue, New York 16, N.Y.*

Rewritten and expanded to include changes in the field since the 1936 edition. Seventy-eight specialists in their respective fields have contributed material on radio antennas, electric wave filters, sound-reproduction systems, iron-core transformers, etc.

There is a complete discussion of frequency modulation and pulse techniques in communications and radar. This edition also contains information on radio devices for navigation, fundamental optics for the television engineer and latest advances in use of electricity in medicine.

Capacitors

CAPACITORS FOR INDUSTRY, *Edited by W C Bloomquist of General Electric Co.* 6x9, 246 *pp*. $4.50. *John Wiley and Sons Inc, 440 Fourth Ave, New York 16, N.Y.*

Practical everyday application data in tabular and curve form. As a result the answer to a specific problem can often be found directly without solution of the right triangle or use of complex algebra. Many examples are included to illustrate the use of given data.

This book is valuable to the industrial plant engineer, electrician, utility power salesman, consulting engineers and industrial power-application engineers. Throughout, the concept of the capacitor as a kilovar generator is used in describing the function of a shunt capacitor. This helps in understanding the use of capacitors for power-factor improvement.

Lubricants

ASTM STANDARDS ON PETROLEUM PRODUCTS AND LUBRICANTS. *Prepared by ASTM Committee D-2.* 6x9, 780 *pp*, $5.50 *paper*; $6.15 *cloth. ASTM, 1916 Race St, Philadelphia 3, Pa.*

Latest compilation of these *Standards* brings together in compact form most of the ASTM standards, test methods and specifications widely used in the field. There are groups of widely used standards including the following: crude petroleum, tractor and diesel fuels, lubricating oils, turbine oils, electrical insulating oils, greases, etc.

New material includes tentative test methods for askarels, lubricating-oil additives and their concentrates, apparent viscosity of lubricating greases.

Instrument Transformers

MANUAL OF INSTRUMENT TRANSFORMERS 73 *pp*, 8x11, $1. *Published by Meter and Instrument Div, distributed through Advertising and Sales Promotion Div, General Electric Co, Schenectady 5, N.Y.*

Designed to cover the practical aspects in using instrument transformers for those in the fields of power generation, transmission and applications involving metering and relaying.

The manual was written to help the reader apply standard transformers to his own needs rather than make him an accomplished designer of instrument transformers. Hence with this intent in mind all theory and design problems are summarized.

How to Run a Plant

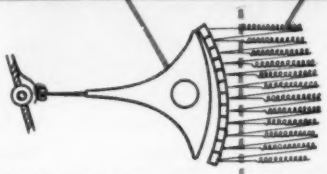
PLANT ENGINEERING HANDBOOK (1950), *by William Staniar, editor-in-chief, and 87 contributors.* 2007 *pp*, 6x9, 1404 *illust*, 503 *tables, semi-flexible binding.* $15. *McGraw-Hill Book Co*, 330 *W* 42*nd St, New York.*

Written for industrial and power engineers, this compilation shows how to run an industrial plant efficiently and economically. It is a compendium of industrial know-how, presented in greater detail in reference works covering specific fields. It does not replace standard engineering handbooks but supplements and extends them.

Its 35 sections cover management engineering, industrial construction, power plants, refrigeration, industrial process air conditioning, industrial power distribution, mechanical power transmission, water purification and treatment, materials handling, lubrication and a host of related subjects vital to efficient operation of industrial and institutional plants.

(*Continued on page* 168)

HOLDS VOLTAGE within ½ of 1%



Sealed, dust-tight front portion of regulator housing contains *Rocking Contact* sector pivoted in jeweled bearings. The smooth working, hard graphite sector face rocks on a curved silver surfaced commutator . . . regulates with slight movement . . . reduces wear.

Ventilated rear section contains resistance elements. Each resistance element is wire wound, accurately designed according to the characteristics of your generating equipment. They are connected to the commutator segments within the dust-tight front section.

ALLIS-CHALMERS

ROCKING CONTACT

Generator Voltage Regulator

POWER PLANT CONTROL

YEAR AFTER YEAR, regardless of line or load disturbances, proper voltage is accurately maintained. This is the kind of performance you can expect from *Rocking Contact* Voltage Regulators . . . it is the kind of performance users are getting!

"Regulation is tops!" says one user. "Put in service ten years ago and still no sign of needed maintenance," says another. "Not one penny for maintenance in fifteen years of continuous service," says still another.

And there is a reason for this trouble-free performance. *Rocking Contact* Voltage Regulators are precision built . . . require no delicate adjustments. *Rocking Contact* sectors are supported in jeweled bearings, rock on carefully machined commutator segments heavily plated with silver. Just a slight *rocking* motion regulates voltage by varying resistance in the exciter shunt field circuit. Response is fast . . . regulation accurate to within ½ of 1%.

Rocking Contact Regulators stay accurate . . . operate for years without repair or maintenance. Call your nearby A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin for more information.

A-3269

Rocking Contact, Regulex and Synchro-Operator are Allis-Chalmers trademarks.

A-C ALLIS-CHALMERS

ROTATING GENERATOR VOLTAGE REGULATOR

REGULEX Generator Voltage Regulators are recommended for use with large generators where field forcing and extremely fast response are required. High amplification of small changes produces immediate, strong corrective action. Similar to a dc generator in construction, it has nothing to get out of adjustment . . . replaces pilot exciter.

AUTOMATIC SYNCHRONIZER FOR ROTATING MACHINERY

The SYNCHRO-OPERATOR automatically brings the speed of synchronous condensers, alternators and frequency changers to synchronism. While doing so, it indicates relative speed, which machine is faster, phase angle between machines, and the exact point of synchronism. Breaker is automatically closed at the exact point of synchronism. Send for leaflet 14S6386B.

PLANT EQUIPMENT NEWS

Published monthly as a service to readers

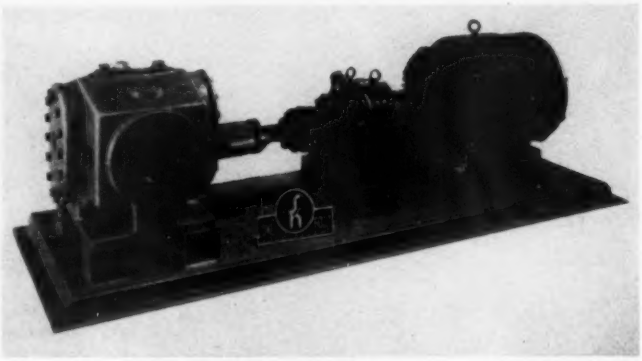
Your information center for new products to solve plant problems. Spot what you need, use handy cards p 188a, to get more details

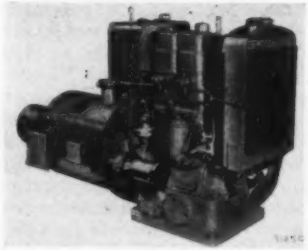
STEAM-JACKETED PUMP P204

A steam-jacketed herringbone gear pump handles viscous liquids at high temperature. To insure even thermal distribution, the steam jacket covers all internal parts. The inlet, outlet and cover flanges are cast integral with the pump base. Rigid housing construction eliminates distortion due to pipe strain or misalignment. Straight-bore housing prevents shaft deflection. Shafts are heavy-duty alloy steel, finish ground.

Pressure on the stuffing box is dissipated through a channel in the cover plates. Steam connections on the pump jackets are easy to get at and are designed to permit a variety of piping arrangements.

Schutte & Koerting Co, Dept P-A, 12th & Thompson St, Phila. 22, Pa.





SELF-CONTAINED DIESELS P246

Type 4FS2 diesel supplements type 4FS1 single-cylinder 10- to 15-hp diesel. Rating of 4FS2 is 20 to 30 hp within speed range of 1200 to 1800 rpm. Bore is 4.5 in., stroke 5.25 in. Four-cycle, mechanical injection engine is vertical and classed as extra-heavy duty. It is a 2-cylinder unit.

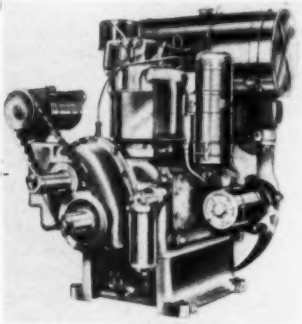
Engines drive dc or ac generators, 6 to 20 kw at all standard voltages, 50 or 60 cycles. Units are suitable for many applications including standby service in public buildings. Engine is fitted with centrifugal pump if unit of this rating is desired for pumping service. Pumping units cover range of 200 to 2400 gpm at heads from 25 to 220 ft. Clutch or stub-shaft power takeoff is fitted for direct or belt drive.

Nordberg Mfg Co, Milwaukee 7, Wis.

HAND TOOL P219

Streamlined, slim, light-in-weight, well-balanced line of combination and open-end wrenches in all sizes, is made in long and short series with box wrench end in either single or double hex. Important feature, according to the maker, is development of conveniently narrow heads without sacrifice of tool strength.

Bonney Forge & Tool Works, Allentown, Pa.



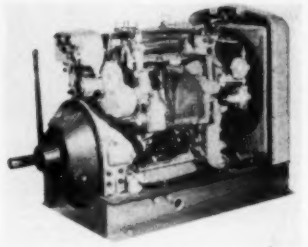
AIR-COOLED DIESELS P257

Two models are available. Single-cylinder unit has 8-hp rating at 1500 rpm, 2-cyl unit develops 20 hp at 1800 rpm. Both models have 4¼-in. bore and stroke. Engines are suitable for 3- to 10-kw generator drive. Both models may be furnished with standard SAE bell housing mounted on flywheel cowl. Flywheel driving member and adapter ring accept standard No. 4 SAE clutch. Units are suitable for driving pumps, compressors, generators, etc.

Either hand or electric starting may be used. Air for cooling is obtained from engine flywheel, which acts like a fan, forcing air around cylinders, injectors, crankcase and other parts requiring cooling. Fuel consumption of engines is low. Engines are manufactured by Armstrong-Siddeley.

Lister-Blackstone, Inc, 420 Lexington Ave, New York 17, N. Y.

For more data on these items, use post cards, p188a. Identify request with P and number.



DUAL-FUEL ENGINES P253

Series 71 diesel engines can now be fitted to burn natural gas in accordance with true diesel high-compression principles. Option is available both on new engines leaving factory and engines already in use. For latter, a factory-engineered kit is used for changeover. After changeover, engines burn either natural gas with a pilot charge of diesel fuel or diesel fuel alone. Change from dual-fuel to diesel is made instantly by moving small lever on gas-governor assembly.

Dual-fuel unit has no electrical ignition system. To date builder recommends operation only on natural gas.

Detroit Diesel Engine Div, General Motors Corp, 13400 W Outer Drive, Detroit 28, Mich.

ELECTRONIC HYGROMETER P237

Direct, relative-humidity readings without the use of psychrometric charts and for remote locations (up to 1000 ft) are now possible with an electronic hygrometer that employs a sensing element about the size of a matchbook cover as its heart.

The element consists of a clear, plastic base on which are mounted electrodes that look like the teeth of a comb. These electrodes are pure leaf gold pressed onto the

Why such preference for CRANE Pressure-Seal Bonnet Valves?

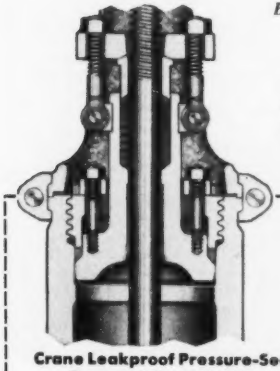
In power plants of all sizes . . . here and abroad . . . Crane Pressure-Seal Bonnet Valves are today regarded as standard equipment. By their performance alone they've earned such recognition. For these valves—with typical, dependable Crane Quality design, construction, and materials—have overcome the major problems of controlling high pressure steam.

Most important, of course, is their revolutionary bonnet sealing principle, eliminating bonnet joint leakage and bonnet joint maintenance. Substantially smaller and lighter than conventional valves, these valves are easier to handle . . . save on erection costs. New flexible disc gives easier operation. Streamlining of body design minimizes operating stresses . . . simplifies application of insulation.

Crane Pressure-Seal Bonnet Valves are made in gate, globe, angle, and stop-check patterns. They can be used in old plants as well as new. Get descriptive circular AD1819 from your Crane Branch or Wholesaler.

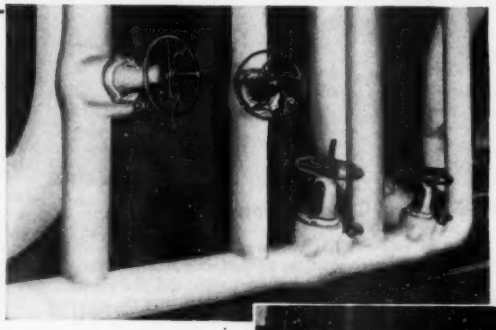
CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

Typical installations demonstrating the superiority of Crane Pressure-Seal Bonnet Valves for high pressure power piping.



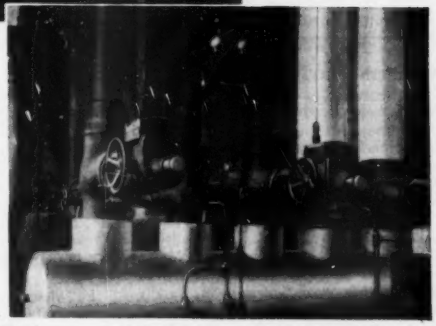
Crane Leakproof Pressure-Seal Bonnet Joint Principle

The bonnet joint as shown above is inside the valve, and the sealing element is a wedge-shaped seal ring. Internal fluid pressure, acting upon the entire underside of the bonnet, forces the bonnet against the seal ring; this wedges the metal seal ring between the body and bonnet, forming a pressure-tight metal-to-metal joint.



BOILER FEEDWATER HEADER *in large central station equipped with Crane 900-Pound Pressure-Seal Bonnet Gates and Angle By-pass Valves.*

Y-Pattern Globe 1500-Pound. Sizes: 1 to 4-inch.
Gate Valve 600, 900, and 1500-Pound. Sizes: 1 to 24-inch.
Angle Stop-Check 900 and 1500-Pound. Sizes: 6 to 12-inch.



PARIS, FRANCE . . . *Crane 1500-Pound Motor-Operated Pressure-Seal Bonnet Gates, on main steam header in a new central station.*

EVERYTHING FOR EVERY PIPING SYSTEM

CRANE

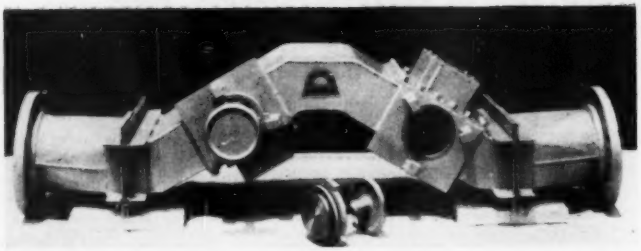
VALVES • FITTINGS • PIPE • PLUMBING AND HEATING

EQUIPMENT NEWS *CONTINUED*

plastic base and separated from each other about like the teeth of two interlocked combs. Entire element is coated with a thin solution of chemical salts.

The sensing element determines the amount of moisture in the air by measuring a minute change in electricity carried by the salts between the teeth of the electrodes. The salt film carries more current in moist air. The electrical charge measured by the element is amplified through electronic tubes. The amplifier can then be made to operate equipment, adding and taking moisture from the air in accordance with humidity desired.

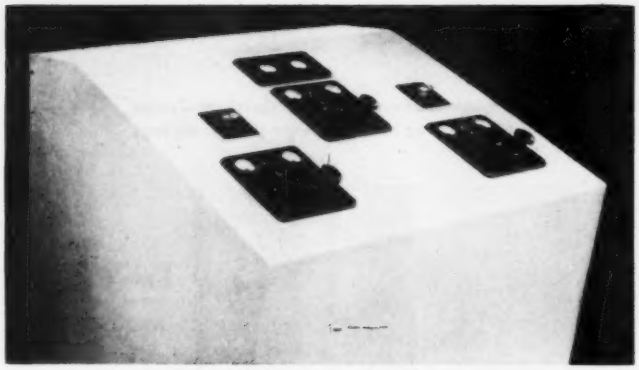
Minneapolis-Honeywell Regulator Co, Wayne and Roberts Ave, Phila., Pa.



MAGNET SEPARATOR P205

Pressure-tight nonelectric magnetic separator removes stray iron from liquids, slurries, and slips flowing in pipelines, 6 to 20 in. in diameter. It prevents tramp iron damage to refiner processing equipment, pumps and grinders. Performs satisfactorily with material flows of 50 to 250 cfm and at pressures up to 45 psi.

Eriez Manufacturing Co, Erie, Pa.



Electronic Master Combustion Control

P201 • Increased centralization of automatic control places more responsibility on fewer operators and on the control system for combustion and process applications. To make it easier to meet these conditions an electronic master combustion control has been developed. An electronic link connecting the master to the actuators readily eliminates the distance problem.

Each final control element is remotely linked to its master by an electronic circuit similar to an ac wheatstone bridge. This link consists of two voltage dividers or slide wires connected through an amplifier. The sender slide wire, comparable to two legs of a bridge circuit, is mounted on the master element. The receiving slide wire, the other two legs of the bridge, is mounted on the actuators and controls the fuel feeders, and air-control devices.

The position contactor on the receiving slide wire is driven to follow and repeat the position of the position contactor on the sending or master slide wire. Final regulating element controlled by the receiving slide wire assumes the exact position dictated by the master.

Simple, compact and interchangeable parts provide a flexible-control system on a condensed panel area. All parts subjected to replacement are mounted on compact plug-in units, easily interchanged and replaced by spare units.

Republic Flow Meters Co, 2240 Diversey Parkway, Chicago 47, Ill.

PUMP AND MOTOR P206

Close-coupled motor-driven pump has sealed motor bearings, a unit cast frame, double seal on front motor bearing and large opening in frame between the pump and motor to make packing maintenance easy. Ratings are 10 to 500 gpm at heads to 220 ft.

Motor has double-dipped and double-baked stator, a rotor winding of die-cast aluminum, and ventilating fans. Motors range from ¾ to 10 hp. They are available in drip-proof, splash-proof, totally-enclosed fan-cooled or explosion-proof types.

Allis-Chalmers Mfg Co, 922 S. 70 St, Milwaukee, Wis.

INPUT CONTROLLER P233

Accurate, automatic control of temperature for electrically heated industrial equipment is possible with the Series 4700 *Atcotronic* input controller. It is based on a rate of charge and discharge of a capacitor that enables the user to "line out" without undue overshooting. It has the ability to operate with a very narrow proportional band (often 2%), and eliminates set point shifts with varied load changes.

Automatic Temperature Control Co, Inc, 5200 Pulaski Ave, Philadelphia 44, Pa.

SWITCHBOARD INSTRUMENTS P238

Full-view Type K-24 circular scale provides maximum readability from the steepest angles. There are no objectionable shadows on the scale even under bad lighting conditions.

Westinghouse Electric Corp, 306 Fourth Ave, Box 1017, Pittsburgh 30, Pa.

For more data on these items, use post cards, p188a. Identify request with P and number.

AIR COMPRESSORS P250

Horizontal duplex motor-driven compressors are fitted with anti-friction roller bearings throughout. Standard sizes of *O-CE* compressors are available in capacities of 350 to 10,000 cfm. They are 2-stage units suitable for air or gas compression. Three- or five-step control is furnished.

Chicago Pneumatic Tool Co, 6 E 44th St, New York 17, N. Y.

MATERIALS-HANDLING PUMP P232

Air-operated high-volume materials-handling pump, the *Mogul-Powerflo*, carries a specially patented device called the *Evenflo* to prevent spurting. Pump supplies industrial spray materials through hoses for spray gun, pole gun, or extrusion gun applications. Extra-high-volume pumps operate within a broad air-pressure range from 20 to 175 psi, fired by air compressors with either large or small output capacity. The standard pump weighs only 35 lb. Its power head is cast aluminum. Air motor

"Even *the UNUSUAL* can include *the CONVENTIONAL*"—REVERE

ATMOSPHERIC TOWER OVERHEAD CONDENSERS

Each battery of 6 has a total capacity of 60,000,000 BTU/hr with 18,000 square feet of effective surface. Made by Henry Vogt Machine Co., Louisville, Ky. Revere Naval Brass fixed end plates are 38½ in. diameter by 2⅛ in. thick, floating end plates are 35¾ in. diameter by 2 in.

These Henry Vogt Machine Co. condensers have an unusual feature: vapor belts in the shells to feed more copious and uniform flows of vapor than are obtained by the usual single nozzles.

Inside the condensers, the tubes are rolled into Revere Naval Brass Tube Sheets.

The use of Revere Naval Brass for this purpose is completely conventional in condenser building practice. Revere Naval Brass is corrosion resistant, strong, tough, durable. Every mechanic on the production line knows how to fabricate it. Every maintenance man knows how to treat it when doing a servicing job. Thousands of Revere Naval Brass plates are in daily use in condensers and other heat exchangers built by all the best manufacturers. Some of these plates have been in service for decades.

Revere has alloys for your unusual design features too. Some of these are conventional, made to do unusual jobs because the Revere Technical Advisory Service knows where and when to recommend them. Others are less well known.

When you work out an unusual design you want to concentrate your attention on the unusual features. Under those conditions, use the time tested, service proven, utterly dependable standard Revere alloys in the standard parts of your design and you will be able to forget those parts and keep your attention where it is needed.

For any problem at all that involves the use of metals, consult the Revere Technical Advisors. Their knowledge, skill, experience, contacts (yes, we ask questions as well as answer them) can add up to money in the bank for you.

REVERE 150th YEAR OF SERVICE TO AMERICA

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

• • •

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere.

SEE "MEET THE PRESS" ON NBC TELEVISION EVERY SUNDAY

incorporates steel forgings and machined castings for durability, large poppet valves for greater efficiency.

Gray Co, Inc, Industrial Div, Graco Square, Minneapolis 13, Minn.

CHEMICAL-PROOF PACKING P234

A V-type packing, *Chemiseal No. 810V*, combines the advantages of Teflon, a chemically inert heat-resistant anti-hesive packing material with a design that gives solid mechanical resiliency, permitting a tight seal at low gland pressure. Packing is supplied as a series of V-shaped rings. Under compression in the stuffing box, each ring acts as a wedge, forcing the lips of the next ring tightly against spindle and stuffing box. Sealing action derives partly from flexing of the rings, and does not depend entirely on deformation.

Teflon Products Div, United States Gasket Co, PO Box 93, Camden, N. J.

COMPRESSED-AIR ALARM P256

Low-pressure warning device whistles shrill alarm when pressure in any compressed-air system falls below minimum predetermined pressure for safe or efficient opration of equipment. Alarm is fully mechanical, entirely automatic and completely self-contained. A few applications are air chucks and clamping fixtures, instrument or control air, dry sprinkler systems, air presses, air clutches and brakes, etc.

Airlarm, PO Box 13034, Houston 19, Texas

SPACE-HEATING MAT P229

Local warming of chilled or cold working areas can be accomplished with the *Dura-Thermal Mat*. It combines features of a wire coil door mat with a large area electric element. Hard steel wire coils are wound over a 28-watt 120-v metal-encased element distributed over a 16x27-in. mat area. The whole is enclosed in a heavy frame with protective rails of tubular burnished aluminum. Used as a floor mat, about 15% of the output is radiant heat and the remainder convective.

W B Snook Enterprises, 751 Loma Verde Ave, Palo Alto, Calif.

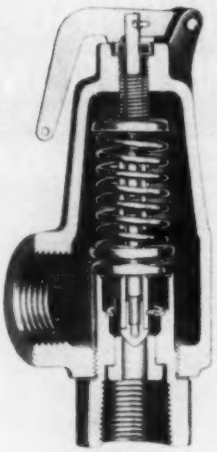
CENTRIFUGAL GOVERNOR P213

Governor designed for accurate control, covers a broad operating range, with close regulation regardless of load conditions. The spring system has wide adjustment and eliminates the use of exact pulley sizes to insure accurate performance.

Made primarily for belt drive, the governor can be adapted for gear operation and may be supplied with or without a speed-control lever operated from the dash. Ball-bearing throttle boxes are supplied where necessary.

Ball, roller and needle bearings, used at all load and friction points, provide smooth free-running operation, insure sensitive control and provide long life.

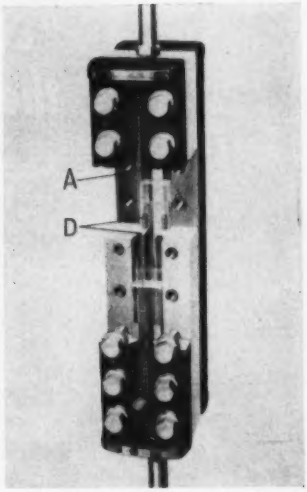
Hoof Products Co, 6543 S Laramie St, Chicago, 38, Ill.



SAFETY RELIEF VALVES P255

Large-capacity safety relief valves are designed for domestic water heaters and tanks. Opening pressures are 45, 75, 100 and 150 psi. All inlet connections ¾ in., outlet 1 in. Valves are rated in Btu capacity, and it is possible to select a valve that opens at desired pressure and has capacity equivalent to heat output of firing equipment.

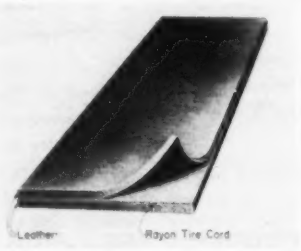
McDonnell & Miller, Inc, 3500 N Spaulding Ave, Chicago 18, Ill.



WATER-LEVEL GASKET P218

Improved gasket is coated with special compound that prevents it adhering to gage metal surfaces under high pressure and high temperature. When glasses or gaskets of high pressure water-level gages are replaced, the *Frelon* gasket, a molded pressure sealed design, is in the groove of the gage insert body. Result is an improvement in water-gage maintenance.

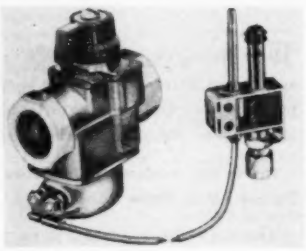
Yarnall-Waring Co, Mermaid Lane, Philadelphia 18, Pa.



RAYON-CORD LEATHER BELT P210

Flat leather belting consists of a layer of rayon tire cords cemented between two layers of leather belting. It has low stretch and can be scarfed and made endless with the same ease and methods as any other flat leather belt. Regular belt fasteners or lacing can also be used in the customary manner. It has the same degree of salvage-ability as ordinary belting and can be handled in the same way. Industrial applications include woodworking, textile, paper mills and metal working.

Chas. A Schieren Co, 30 Ferry St, New York, N. Y.



SAFETY CONTROL P230

A combination of the 260 Series pilot burner and a new MR-5, ¾-in. gas cock safety valve includes a 100% safety shut-off feature for pilot-flame failure, a removable filter screen to eliminate lint plugging. It also carries a special mounting bracket for various appliance installations to hold both burner and thermocouple in secure operating relations.

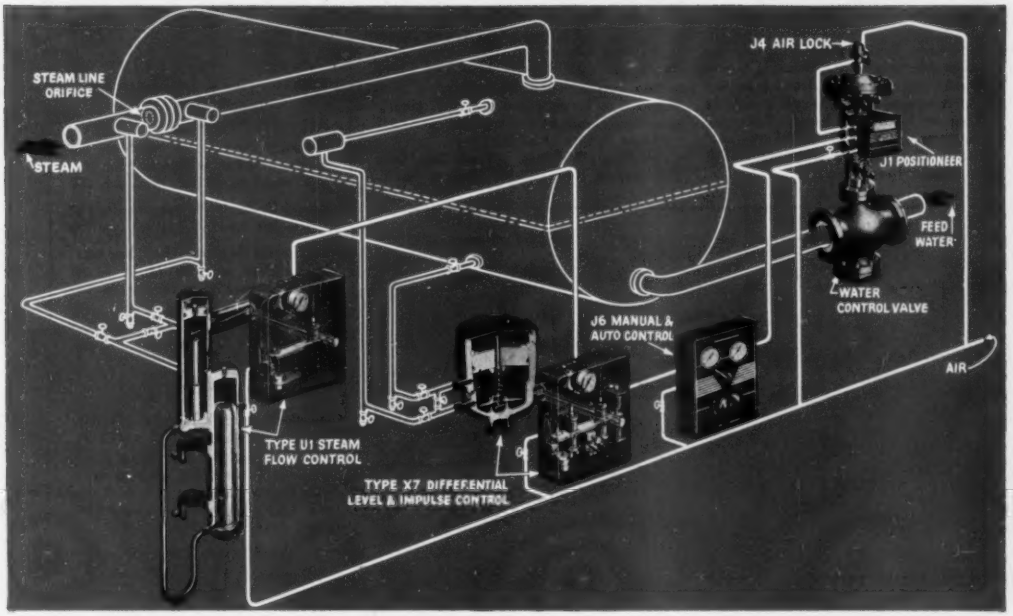
General Controls Co, 801 Allen Ave, Glendale 1, Calif.

CONTROLLED VOLUME PUMP P215

Positive-displacement metering pump has a reciprocating plunger of ⅛-in. diameter. A cam, driven by a fractional-horsepower gearhead motor, actuates the spring-loaded cam follower attached to the plunger.

For more data on these items, use post cards, p188a. Identify request with P and number.

Swartwout Impulse Regulation assures correct feed water supply under any load condition



SWARTWOUT two-element controls—by utilizing the very forces that cause false drum level—produce a corrective impulse that assures correct level even under rapid load swings. Since "shrink" and "swell" are functions of *rate of change,* as well as magnitude of load, only Impulse Regulation gives satisfactory operation under *any rate of change in load of any magnitude.*

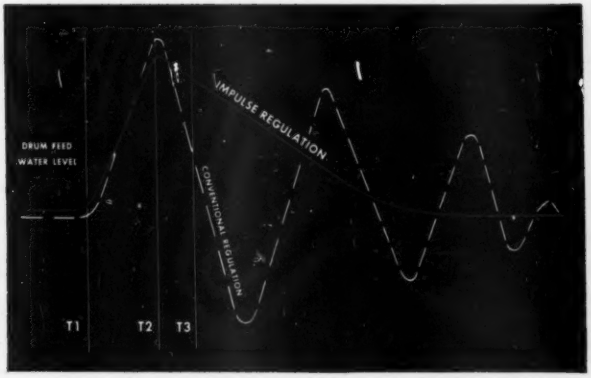
Type U1 flow transmitter takes square root of steam line orifice differential and feeds airloading pressure, which is directly proportional to steam flow at all flows, to X7 differential level and impulse control. X7 unit positions flow valve by sending airloading pressure which is result of combining *rate of change* of steam flow function with water level.

Graph *(right)* shows how proper combination of these forces, plus reset and setback features, assures that valve will give desired operation under *any* load condition. System can be adjusted to maintain drum level constant at all loads, carry it high at high loads, low at low loads, or vice versa. In addition to this FW6 two-element system, Swartwout also makes an FW7 three-element impulse regulating system. Other types include FW5 single-element system and SC (FW1) thermo-hydraulic system.

A-3753

Swartwout

POWER PLANT EQUIPMENT



SEND FOR BULLETINS S-27, S-20-E • THE SWARTWOUT COMPANY, 18511 EUCLID AVENUE, CLEVELAND 12, OHIO

EQUIPMENT NEWS *CONTINUED*

Limiting the travel of the plunger by a simple screw adjustment controls the volume delivered. All bearings are self-lubricating. An oil reservoir, with a visible oil level line, houses and lubricates the cam, cam follower, stroke-adjusting screw.

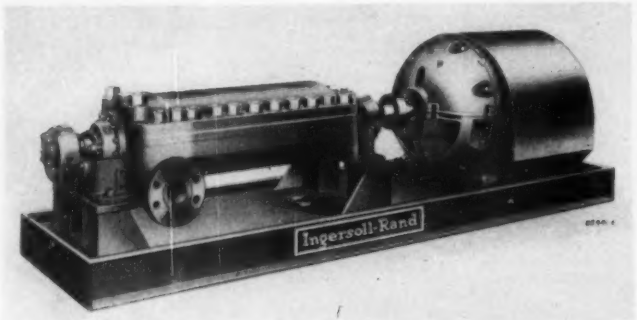
Capacity can be varied from 3 cc per hour at minimum stroke length to 800 cc per hour at full stroke length. Operating pressures up to 1000 psi.

Milton Roy Co, 1305 E. Mermaid Lane, Philadelphia 18, Pa.

SOLDER FLUX P227

Improved aluminum solder flux can be reactivated after drying out by simple addition of tap water. New flux stems from discovery of a chemical combination permitting water as a solvent to replace alcohol. This flux can be used with aluminum solder rods of any commercially available brand with an open flame and, under certain conditions, with a soldering iron. It makes solder flow into the joint, greatly enhancing inherent sealing and pressure-tightness quality of solder.

All-State Welding Alloys Co., Inc, 273 Ferris Ave, White Plains, N. Y.



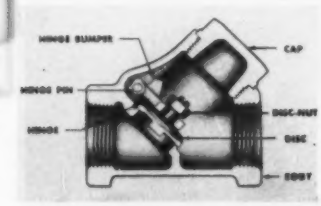
HIGH-PRESSURE PUMP P209

Multistage centrifugal pumps are good up to 1200 psi, with capacities to 1600 gpm. They are built in 3-, 4-, 5- and 6-in. sizes with from 3 to 9 stages. Applications cover a wide range of boiler-feed pipeline pumping, and refinery as well as other general high-pressure industrial services.

These pumps have a cylindrical-bore, horizontally-split casing and a compact, unit-type rotor assembly. The latter is composed of the shaft, impellers, and channel rings. These channel-ring sections contain the multiple volutes and fluid passages, as well as the renewable wearing parts that are common to each stage.

Pressure differential between stages is sealed by corrosion-resistant cast iron or alloy-steel piston rings around the outer diameter of the channel rings. These hydraulic-type step-seal rings have a metal-to-metal fit with the casing. Axial thrust, developed by in-line staging of the single-suction impellers, is counteracted by a hydraulic balancing drum. The drum forms the only high-pressure breakdown in the pump and is accessible through the discharge stuffing-box extension.

Ingersoll-Rand Co, 11 Broadway, New York 4, N. Y.



REGRINDING CHECK VALVES P249

Y-pattern brass swing check valves are in 200- and 300-lb pressure classes. Regrinding type with large cap; maintenance is easy. Screwed-end patterns available in ¼- to 3-in. sizes, inclusive; flanged-end patterns in 1- to 3-in. sizes, inclusive. Valves may be used in lines where flow is horizontal or upward.

Crane Co, 836 S Michigan Ave, Chicago 5, Ill.

END-LOCKING PISTON RING P258

One-piece *Sealock* piston ring has feature that locks one ring end "in" tightly against the other. Locked end is prevented from expanding into ports in a cylinder wall. Rings are suitable for both 2- and 4-cycle engines. Ring gives full sealing against compression blowby.

Double Seal Ring Co, 2065 Montgomery St, Fort Worth 1, Texas

For more data on these items, use post cards, p188a. Identify request with P and number.

Now Take Another Minute To Check These, Too . . .

Expansion Joints. Thermal expansion, vibration or misalignment calls for use of this chemical-proof piping joint ..... p 170

Multipurpose Grease contains oxidation inhibitor. Suitable for all installations, wet, dry or cold ..... p 170

Mercury Switch for hazardous locations. Switch is designed for vertical panel mounting ..... p 172

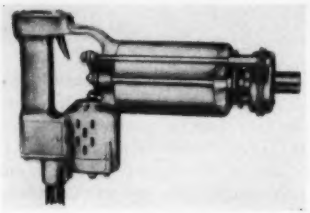
Speed Reducer for output speeds of 115 to 330 rpm ..... p 174

Industrial Dehumidifier has maximum 25-hr capacity of 50 lb of water removed from the air ..... p 176

Automatic Exit Light provides guiding light if regular source of current fails ..... p 180

And Next Month . . .

Outdoor Circuit-Breaker Receptacle. Combination well suited for temporary circuits controlling drills, sanders, compressors, pumps, saws, etc. Receptacles are already wired in; only connections needed are those direct to the line



HAMMER DRILL P220

Electromagnetic hammer drill, Model No. 10-RO, for high-speed hole drilling in concrete, brick and stone, has a carbide-tipped-spiral drill under automatic rotation. A rubber ratchet mechanism, actuated by recoil of each blow of the 3600-blows-per-min piston, reduces operator fatigue.

Syntron Co, Homer City, Pa.

NEOPRENE BELTING P202

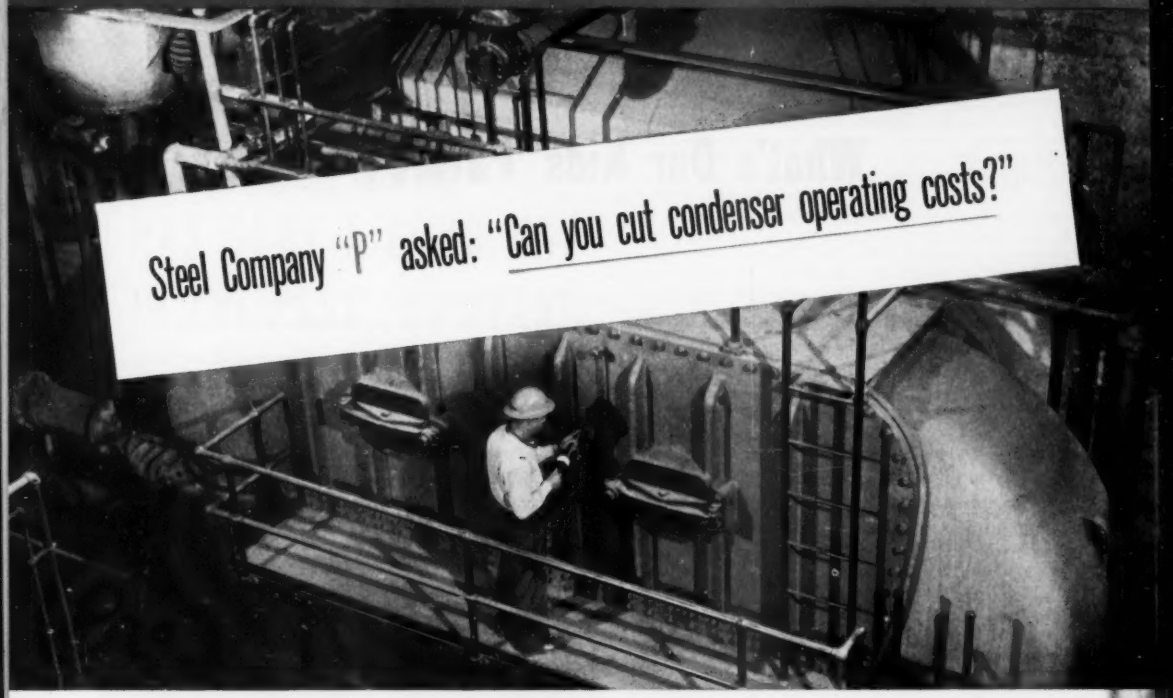
Belt is designed for light conveying and transmission work and adapted to the sanitary requirements of the food industry. It is made in either white or brown. Both types have a smooth neoprene cover on one side and are made in two thicknesses, in any width up to 48 in. They are oil-proof, waterproof, odorless, tasteless, non-toxic, washable, heat resistant, acid and alkaline resistant, and can be vulcanized endless.

Both types have a skim coat of neoprene rubber between all plies, so the fabric is embedded in the protecting

(*Continued on page* 170)

DOWELL SERVICE

CHEMISTRY APPLIED TO MAINTENANCE CLEANING PROBLEMS



Dowell Service saved $87.92 in steam per day!

Dowell Service was used by a major steel company to clean a large turbo blower condenser. After the cleaning, operating figures showed a saving in steam of 8000 lb. per hour or a dollar saving of $87.92 per day. At this rate, *Dowell Service paid for itself in 5½ days!*

There are many places in every industrial plant where Dowell Service can be used to cut operating costs. Wherever deposits on the surfaces of condensers, boilers, heat exchangers, water lines and other equipment are stealing power, Dowell Service can show money-saving results.

Dowell Service has another prime advantage for the maintenance engineer. *It is fast!* Because cleaning is done chemically, time-consuming dismantling is eliminated. Dowell engineers fill the equipment with liquid solvents that go wherever steam and water flow. These solvents are designed to remove deposits quickly, efficiently and economically.

Do you have a cleaning problem, too . . . a place where deposits are causing a maintenance headache? Call Dowell. Skilled cleaning engineers are available for consultation at no obligation.

Other recent Dowell jobs:

In a large textile plant, the heating time required in kier heaters was cut one-third, following cleaning with Dowell Service.

•

Houdry catalyst cases cleaned by Dowell Service for a large refinery showed all tubes to be practically metal clean and orifices opened.

•

Thirty-three year old water well, cleaned by Dowell Service, showed increase from 64 to 130 g.p.m. with drawdown decrease of 27 feet.

CALL

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Baltimore 18	Detroit 2	Houston 2	Salem, Illinois
Wilmington 99	Chicago 2	New Orleans 12	Borger, Texas
Richmond 19	St. Louis 8	Ft. Worth 2	Midland, Texas
Jacksonville	Indianapolis	Shreveport 69	Wichita Falls, Texas
Atlanta	Louisville	Anniston, Alabama	Lafayette, La.

Long Beach, Oakland, Casper: Dowell Associate—International Cementers, Inc.

DOWELL

A SERVICE ORGANIZATION

What's Our Kids' Future?

If you have sons fresh out of high school, you'll know what I'm talking about. But this problem affects all of us . . . not only as parents interested in the future of our children, but also as citizens interested in the future of our country, and as engineers interested in the future of our profession.

I'm bothered about what the war effort will do to the kids coming out of high school. Sooner or later each boy will find his place in our national effort. Some will go into the ranks of labor. Others will go on to colleges and trade schools to become the engineers and technicians of the future. But most of them will end up in the army, navy or air force.

The main trouble is the uncertainty; few of these kids know what job is cut out for them. Employers, too, are uncertain, and that hurts. Who wants to train a raw kid only to have him drafted in six months to a year? And as for those who should be going to college to assure us of a steady supply of trained engineers, some don't even want to start college with the uncertainty that lies ahead. Many of those that do go don't know how long they'll stay. You can't expect these last to do their best work.

Uncle Sam's draft doesn't help matters much either. His tap on the shoulder comes only a very few months before a boy puts on his khaki. But until Uncle Sam says "yes" or "no," a kid is in no position to plan his immediate future, so he doesn't try.

Well, the result is what I call the "lost years" of American youth—one, two, even three years between high school and "?."

Now I don't want to sound like an alarmist, but it's not healthy. Not only is good man power going to waste, but also this uncertainty may affect an entire generation of our kids, as some of the psychologists will tell you.

Already you can see them lounging around on street corners, wisecracking and carrying on with that devil-may-care attitude boys have at that age. But underneath, although they'll never admit it even to themselves, they're uncertain, uneasy, unwilling or unable to plan very far ahead. Initiative and responsibility go by the boards. This attitude may not only carry on later in life but also start a few years earlier.

Take the average senior in high school. Those who are pointing for a specific trade or for college, etc., have a far different attitude from those who can see only a year or two of loafing while Uncle Sam decides what they do next.

Well, that's the problem. What can we do about it? I'll stick my neck out and say: As long as these kids are having their future planned for them, let's do a real job of it and start sooner.

If we're going to have universal service, let's have it and make it as routine a part of a boy's growing up as high school—at least he'll know where he's going. But if we're going to follow the present system of drafting some, deferring others, let's allow each boy to know his future before he gets out of high school—not after he's been out loafing a year or so. Then he can plan, adjust himself, be happier, more efficient in his appointed task.

I hope you don't think I'm plugging for a regimented society. That's the last thing any of us should want. But as long as our national emergency lasts and our boys can't choose their own futures, let's do our planning of their lives as well as we can and cut out those "lost years." They're dangerous.

George Edwards

Engineer

The Harrisburg Gas Co.

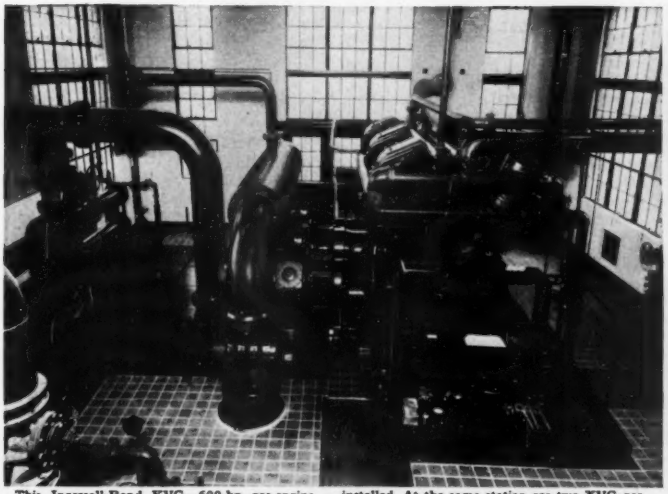
HAS GONE A LONG WAY IN THE PAST 100 YEARS

Erected in 1850 at Harrisburg, Pa., the original plant of The Harrisburg Gas Co. had a maximum output of 25,000 cubic feet per day. Now the company's combined facilities, including a unit under construction, are rated at more than *35,000,000 cubic feet per day!* What's more, growth has continually kept pace with the latest technological advances in the industry. At Steelton, for example, a new catalytic cracking plant has recently been completed—one of the first of its type in the United States.

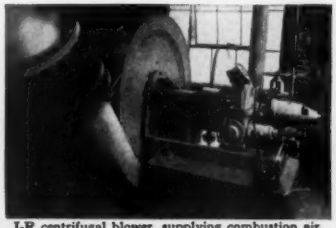
During the past century of progress, The Harrisburg Gas Co. has always placed the emphasis on *continuity of service*, which can be secured only by *quality of construction*. That's one of the reasons why it has repeatedly specified Ingersoll-Rand Compressors and Blowers for all major installations.

The *proved dependability*, operating economy and low-cost maintenance of I-R equipment have become almost a tradition in the gas industry. It took years of experience to build up this reputation—experience in the design, manufacture and application of air and gas handling equipment to meet the rapidly changing needs of the industry. All of this experience is at your disposal—no farther away than your nearest I-R representative.

. . . with the help of dependable I-R equipment like this

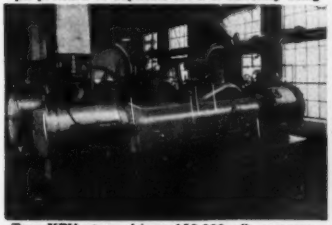


This Ingersoll-Rand KVG, 600-hp gas-engine-driven compressor at the Steelton station can pump 335,000 cubic feet of gas hourly, at 34 psi pressure. A duplicate KVG is currently being installed. At the same station are two XVG gas-engine-driven compressors, each having a capacity of 120,000 cfh.

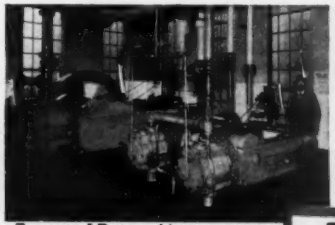


I-R centrifugal blower, supplying combustion air for oil and gas burners in catalytic cracking furnace. Another I-R blower is used for pressure boosting.

I-R steam-driven compressor, of 277 cfm capacity, supplying process air to the cracking furnace at 20 psi.



Two XPV steam-driven 150,000 cfh compressors handling high-pressure distribution for the Harrisburg station.



Two more I-R steam-driven compressors on high-pressure distribution at Harrisburg. The unit at the right has been in service since 1914.

I-R Type 30 compressor supplying 60-psi air for operating the cracking-plant control instruments.

Ingersoll-Rand

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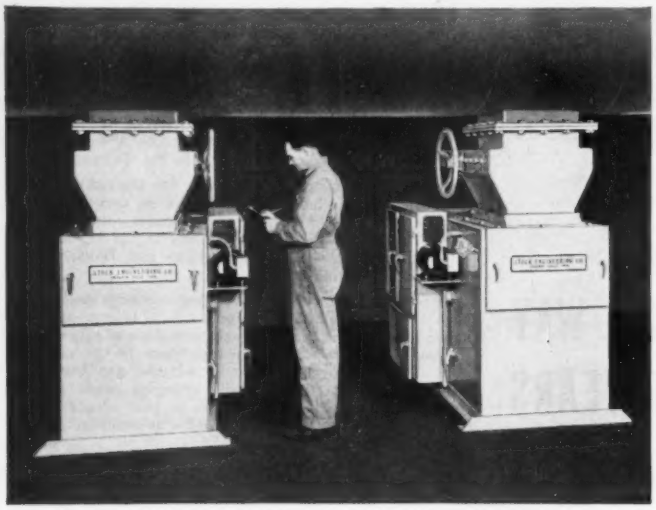
COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES



SMALL SPACE REQUIRED FOR

S-E-CO. COAL SCALES

S-E-Co. Coal Scales are designed with the idea of making them fit into the very minimum of space. For example, the overall height of the 200 pound scale, rated at 10 tons per hour, is 3'-9". The overall width and the overall length are also small.

If you are faced with the problem of fitting a coal scale into a plant arrangement that provides but little space for the coal scale, the S-E-Co. Scale is the machine for you.

Write for dimension prints.

STOCK EQUIPMENT COMPANY

715P Hanna Building ★ Cleveland 15, Ohio

ELECTRONICS

(*Continued from page* 118)

when tube T_1 does not conduct to give the effect of full-wave rectification.

Snubber Circuit. Capacitor C_3 and resistor R_6 form what is called a cushion or snubber circuit. When rectifier tube T_1 is triggered to fire before current ceases to flow through T_2, a highly negative voltage is applied to the latter's anode. This voltage causes the positive's ions within the tube to bombard the anode with such force that they shorten the life of tube T_2. The snubber circuit acts to control the rate of this negative voltage rise to increase the tube's life.

Tube T_4 and resistor R_9 serve the same purpose on the motor-field-coil exciter circuit as do tube T_2 and resistor R_8 on the generator exciter. Also, capacitor C_4 and resistor R_{11} in series serve as a cushion circuit to limit the rate of negative-voltage rise on the anode of T_4.

Grid Potential. Secondary S_2 applies a voltage from its minus terminal through R_{11}, R_{10}, capacitor C_1 to + on S_2, to charge the capacitor. A bias is applied to the grid of tube T_3 from the tap on R_7 to A on speed-control potentiometer P, R_5 to the grid and cathode of T_3, to B on S_2. This voltage is phase shifted relative to the anode volts by the setting of arm A on potentiometer P to cause tube T_3 to conduct at different point on the anode voltage curve to excite the generator-field coils according to motor speed required.

Potentiometer P is part of the phase-shifting network consisting of capacitor C_2 and resistors R_3 and R_4. All resistance of potentiometer P is in section L_1 to L. Section L to L_2 is only an extension of point L to take care of the motor-field control potentiometer P_1.

Motor-Field Control. For drives requiring speeds above motor base the grid circuit of the motor-field rectifier is like that of the generator, as in the diagram. But the two potentiometers connect in tandem to the same speed-adjuster knob. Each potentiometer is connected so it has control of its exciter circuit for only one-half the total speed-adjuster rotation.

Generator potentiometer has control of its exciter over the first half of the speed adjuster, but cannot change generator voltage during the latter half. On the motor's exciter the potentiometer cannot change the field current during first half of speed adjuster's rotation, but can in last half.

In the diagram, assume arm A on L_1 and A_1 on L_2, connected to the same speed-adjuster knob. Turning the knob clockwise moves A from L_1 to L to phase-shift the grid voltage of T_3 to increase the generator voltage. At the

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Famous Gargoyle lubricants are unsurpassed in quality—constantly improved by Socony-Vacuum research. They are backed by 85 years of lubrication experience . . . are recommended by more machine builders than the products of any other oil company. Performance records, in thousands of plants, prove they help increase production, reduce friction and power losses, lower maintenance costs.

Socony-Vacuum—with more lubrication engineers serving industry than any other oil company—can help improve production performance in *your* plant. Why not give us a call?

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WORLD'S GREATEST LUBRICATION KNOWLEDGE AND ENGINEERING SERVICE

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JUST WHAT THE ENGINEER ORDERED
For compact, efficient steam production

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SHIP TO: Naugatuck, Conn.
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TYPE: B
STEAM RATING: 20,000 lbs. steam per hr.
DESIGN PRESSURE: 160 lbs.

TYPE B DESIGN FEATURES

- Factory fabricated boilers require minimum field work.
- In many cases, sizes up to 330 HP can be shipped completely assembled.
- Water tubes along furnace side walls reduce maintenance costs.
- Furnace design provides high efficiency with any method of firing.
- Extremely low head room. Maximum capacity for floor area.
- Can be operated at high overloads without disturbing water level.

Write for free catalog on the Type B or on any of the units listed below.

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BI-4

same time, A_1 is moved from L_3 to L_4, but motor-field excitation has not been changed because L_3 is only an extension of L_4. Moving arm A beyond L does not affect the generator voltage, but moving A_1 toward L_3 cuts potentiometer P_1 resistance in circuit. This phase shifts the grid potential of tube T_3 to reduce the motor's field excitation and increase its speed. Thus, the motor's speed is continually adjusted over the full rotation of the potentiometers, first by armature voltage control and then by motor-field weakening.

Standard drives of this type are built as package units. They consist of a control cabinet that contains the motor-generator mounted on a bedplate in its bottom. All control equipment are made up as subassembly panels, and mounted in the top half of the cabinet. An operator's control station contains the pushbuttons and the dc-motor speed adjuster.

These drives are made for (1) nonreversing without motor-field control (2) nonreversing with motor-field control (3) reversing without motor field control (4) reversing with motor field control. Horsepower of these drives ranges from 1 to 25 in standard ratings. Standard speed range by armature voltage control is 8 to 1 below motor basic speed. Speed range by motor-field control is 1.5 to 1 and 2 to 1 above base speed depending on motor base speed.

The next article will study electronic equipment for liquid-level and pump sequence control.

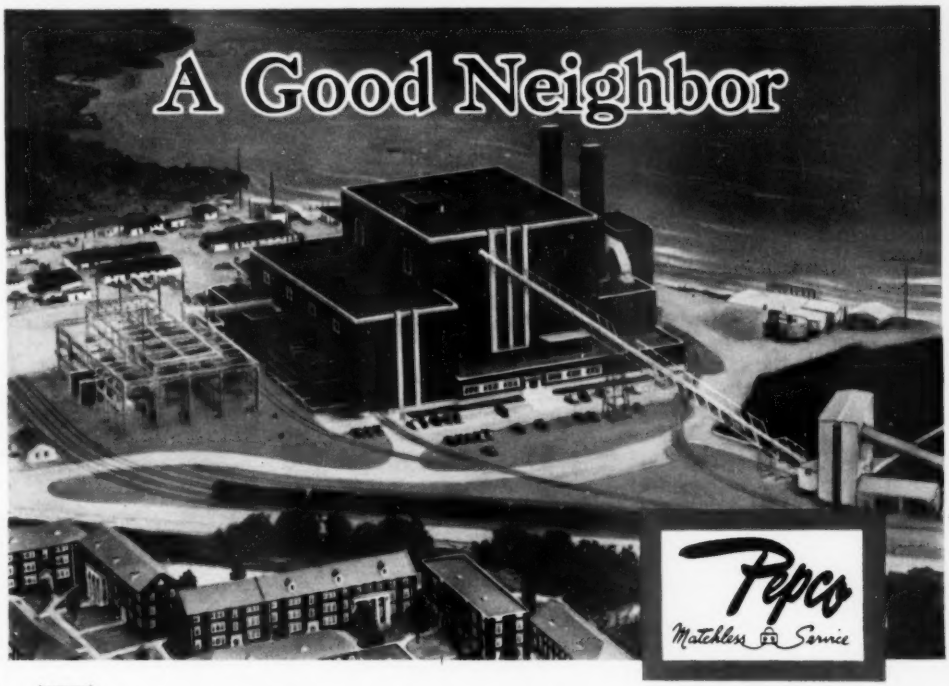
TECHNICAL BRIEFS

(*Continued from page* 132)

supporting hangers for the first-pass superheater soot blowers and in the nonretractable soot-blower elements themselves when this particular boiler operated on bunker-C fuel oil for long periods. Gas-stream temperature in the zone under discussion was 1600 F at rated load on a 450,000-lb-per-hr 900-F 900-psig steam generator.

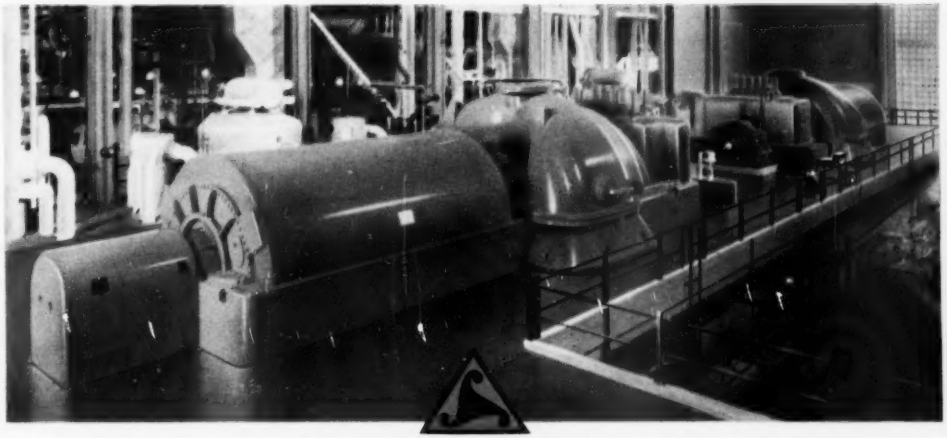
In 1949, this company placed in operation a mercury boiler designed for liquid fuel only. Considerable areas of furnace wall tubes were expected to operate at skin metal temperatures above 1150 F. Following about 3000-hr operation at full-rated load a well-developed selected attack was discovered occurring in zones of highest heat release and where skin metal temperatures were known to exceed the 1150-F standard. This attack appeared in two forms: (1) A "worm tracking" or washing of metal surface of the vertical furnace wall tubes forming grooves about 3/16 in. wide and up to 2 in. long, averaging 0.040 in. in depth. (2) A shallow round pit hole presenting sharply defined edges and clean metal

(*Continued on page* 158)



The new 160,000 kw Potomac River Station of Potomac Electric Power Company was designed to live in a residential neighborhood adjacent to the National Capitol. The architecture is in harmony with near-by apartments.

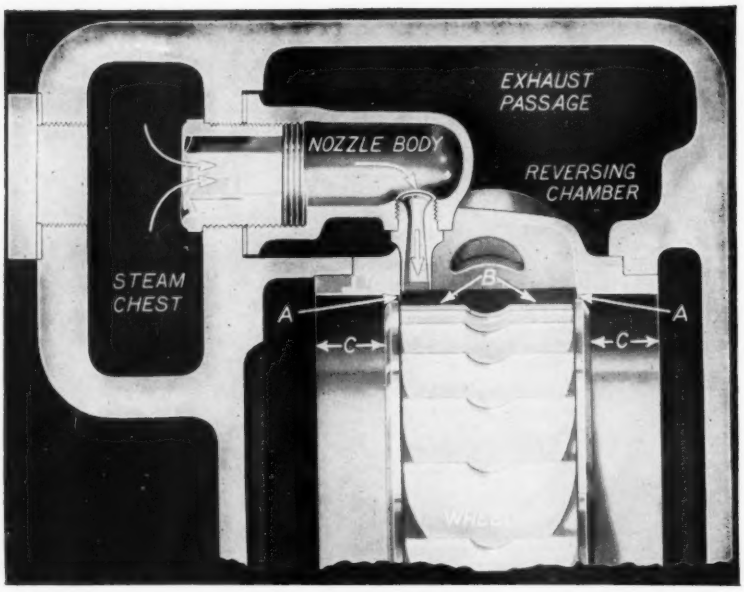
This plant, which supplements the other generating facilities of the Company in serving the District of Columbia and surrounding territory, was designed and constructed by Stone & Webster Engineering Corporation.



STONE & WEBSTER ENGINEERING CORPORATION

SUBSIDIARY OF STONE & WEBSTER, INC.

TERRY



AMPLE CLEARANCES FOR DEPENDABILITY

Large blade and rim clearances and extra large side clearance — one inch — help make Terry One-piece Wheel Turbines highly dependable in operation.

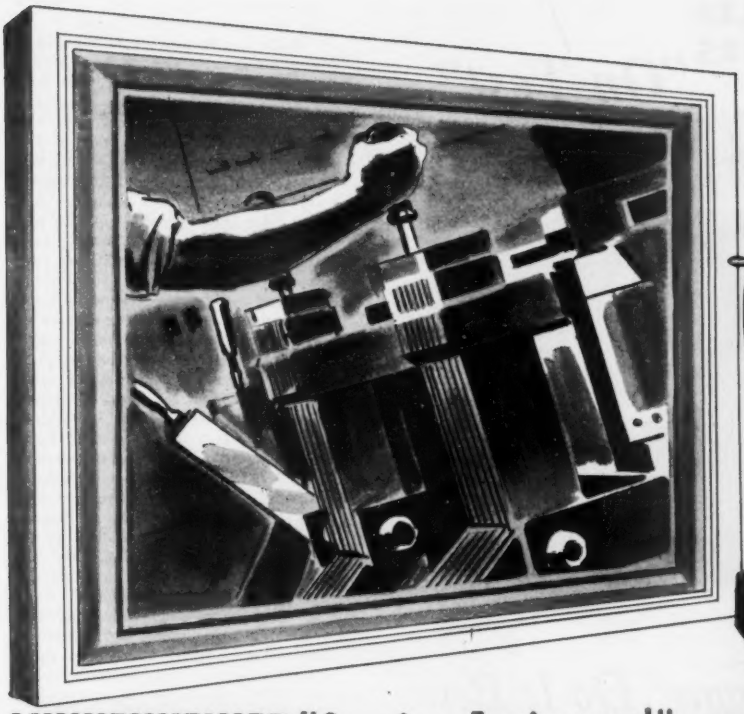
The blades cannot foul because of the protection afforded by the rims, which are not damaged, should rubbing occur.

Note the rim clearance, AA in diagram. Also the large blade clearance, B. Side clearance, CC, is so large that end-play from external thrust cannot damage wheel.

Terry Bulletin S-116 will give you full information on the Terry Wheel Turbine. A request on your business letterhead will bring you a copy.

T-1171

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.



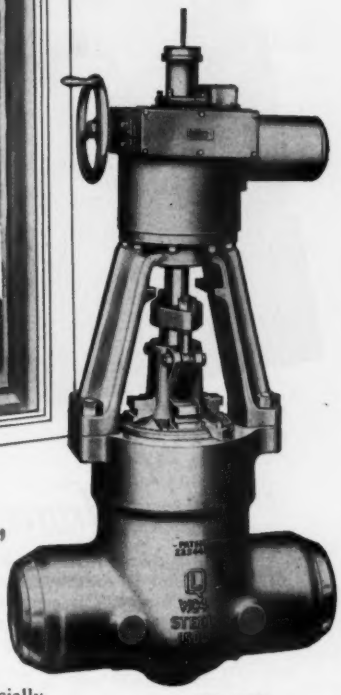


FIG. 1300
BREECH LOCK

LUNKENHEIMER "Service-Engineered" Steel Valves Will Meet YOUR SPECIFIC APPLICATION PROBLEMS

MAINTENANCE costs need specialized attention, these days—especially in the power field, where steel valves are vitally important. There's no cure-all for your valve maintenance problem. It has to be tackled an installation at a time — service by service — and that's where Lunkenheimer engineering comes in.

Lunkenheimer breech-lock valves are your insurance against excessive valve maintenance. Gaskets, rings, flanges, and bolting, all of which tend to induce leakage because of their instability at high pressures and temperatures, have been eliminated. Bodies and bonnets are locked securely together by intermeshing lugs that carry the full internal pressure. Maintenance of the joint is never required, and pressure tightness is unaffected by high pressures, high temperatures, sudden quenches, or creep. It's simplicity itself — an exclusive, patented design, developed by Lunkenheimer to eliminate any possibility of bonnet-joint leakage. *Write for your copy of a complete 16-page catalog-brochure describing Breech Lock designs, materials, and specifications in detail. The quantity is limited, so please use your company letterhead and write today to The Lunkenheimer Company, Box 360A, Cincinnati 14, Ohio.*

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LUNKENHEIMER

THE ONE *Great* NAME IN VALVES

L-850-130

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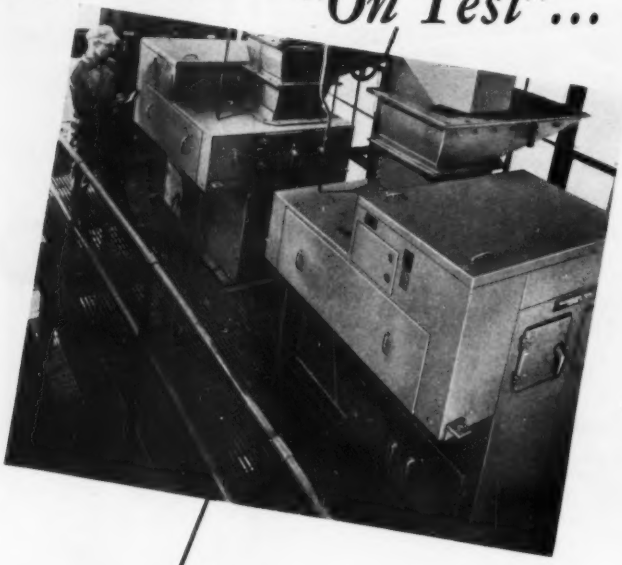

"Richardsons" Do It Best

When a Richardson scale is weighing and feeding your coal you have the most dependable, accurate, automatic equipment that money can buy. Without an equal for year-in, year-out service, every Richardson scale is backed by 60 years' experience designing automatic materials weighing equipment and over 40 years of building coal scales.

Current models will be found even more *rugged, dependable, accurate, dust tight*—than the old units, some of which are still in use after 30 years of service. They do not "hang up" on wet coal or dry—coarse coal or fine—but give accurate records of coal consumed per boiler—by the hour, shift, day, week or month.

Through this continuous service, Richardson has gained a knowledge which has kept pace with the more rigid requirements of present day and future power plants and resulted in constant modernization of equipment each year.

In your district there is a factory-trained Richardson Service Engineer. If your Richardson scale needs a parts or operational check-up, call him in . . . you will be sure of a thorough, competent and courteous inspection, and worthwhile recommendations for getting maximum efficiency from your boiler plant.

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Model K-39, for pressure tight (up to 60" of water), large capacity service—400-500 lbs. per discharge—Bulletin No. 0250

EE39, for dust tight, average service—200-300 lbs. per discharge—Bulletin No. 0150

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on removal of slag covering as though the steel had gone into solution.

While the mechanics of the attack were not entirely clear, it was thought a protective coating applied to the tube surfaces might keep these lethal ash combinations from contact with the metal. Accordingly, a section of the furnace wall was cleaned of all ash using scale hammers, and then coated with a water mix of a high-silica fire clay. A second thought was also put into action, and that was a very close check on combustion conditions, particularly in this area. The two oil burners near each of the side walls were replaced by steam atomizing burners to secure better atomization and a more compact flame shape. The fire-clay coating had all fallen from the tube surface at end of ten days' operation.

At present, the company is working along two separate and distinct lines toward a solution of this wastage problem. First, is it necessary to introduce an inhibitive or an additive into the fuel stream that will inhibit the harmful constituents of the oil directly, or else raise the melting point of the resultant ash above a plastic state at operating melting temperatures? Second approach is to determine the best coating to be applied to the tubes themselves to resist attack. To date this would appear to be a metallic coating. A 26% chrome overlay on samples of the alloy tubing in service demonstrated a 10-fold increase in resistance to attack under controlled laboratory conditions. *ASME paper, No. 50-A-136.*

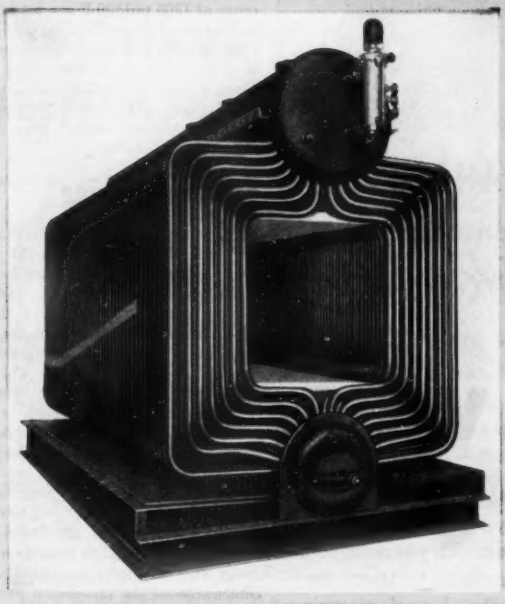
VANADIUM ATTACK ON METALS AT HIGH AND LOW TEMPERATURES AND THE FOULING OF TUBE BANKS, *by O L Wood, Jr, General Electric Co.* This type of attack is found on metals above 1000 F subject to bunker-C, that is Grade 6, fuel-oil firing and is associated with the presence of vanadium in the fuel. Data are still required, however, to confirm this completely. There appears to be no record of corrosive attack during the time vanadium-free domestic bunker-C fuel oil was in commercial use. But there is an outside chance that operating temperatures in power plants at that time were below the point where attack now seems prevalent.

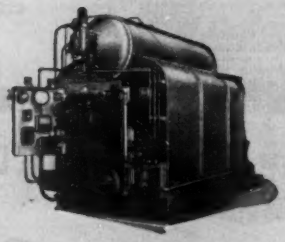
It should be emphasized that vanadium oxide may not of itself cause the attack, but if present its action with other ingredients may bring out corrosive tendency of this oil. So users are faced with severe corrosive attack on high-temperature equipment with consequent outages and costly replacements. The attack takes the form of localized pitting and "worm tracking," fluxing, or washing away of the metal, and accelerated wastage. The exact kind of attack varies with temperature, proximity of flame, and resulting com-

ERIE CITY KEYSTONE STEAM GENERATOR

Offers

2-DRUM WATER TUBE DESIGN IN A COMPACT STEAM GENERATOR

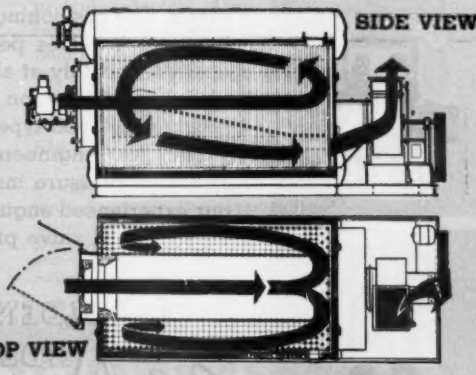




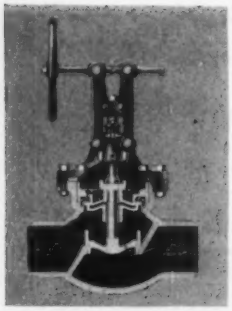
Here's big boiler performance in small cubage. Keystone combines in a factory assembled unit: low head 2-drum water tube boiler complete with boiler trim, a heavily insulated steel casing—automatic burner for gas, oil or both interchangeably—induced draft equipment and instrument panel with all controls mounted. Complete range of sizes from 75 to 800 hp. at pressures from 160 p.s.i. Write for Bulletin SB-38.

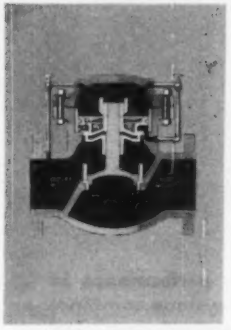
Note THE UNIQUE 3-PASS GAS TRAVEL

Hot gases contact solid side banks of water tubes in first pass to the rear of the Keystone, divide to left and right and are deflected upwards and over inclined baffles in both side water tube elements, again contacting bare metal heating surfaces—make return or third pass under these baffles, contacting bare metal again in the return trip to the rear and out of the boiler. Quiet induced draft fan provides all the draft required for top ratings. Spent gases need only be vented. No stack is required.



ERIE CITY IRON WORKS *1401 East Ave.* **ERIE, PA.**





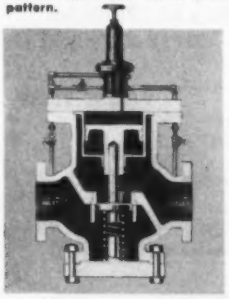
Reading from top to bottom:

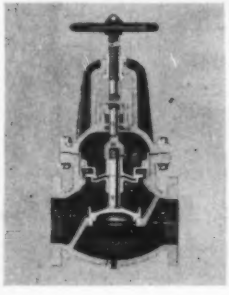
G-A double-cushioned single-acting non-return valve, toggle yoke assembly, globe pattern.

G-A double-cushioned check valve, globe pattern.

G-A cushioned unloading valve, globe pattern.

G-A combined throttle and automatic engine stop valve, globe pattern.





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against sudden shock,
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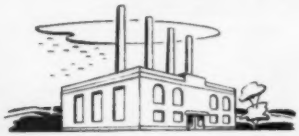

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bination of vanadium and other ingredients in the oil during combustion. Tube hangers, spacers, supports in boilers, and combustion liners in gas turbines rapidly corrode and waste away.

It has been suggested that sulfate in the ash, particularly sodium sulfate, may be the real corrosive agent. Laboratory tests indicate pure sodium sulfate produces a severe and rapid corrosive attack provided it is heated above its melting temperature of 1660 F. Normal tube temperature does not reach this, but hangers and supports do. So attacks on tube surfaces in the range of 1200 to 1300 F are not believed to be caused by sodium sulfate alone. They may be a result of the formation of a low melting eutectic with vanadium. Slagging troubles in boiler units are a result of this low fusion temperature of bunker-C fuel-oil ash. *ASME paper, No. 50-A-163.*

Air Conditioning

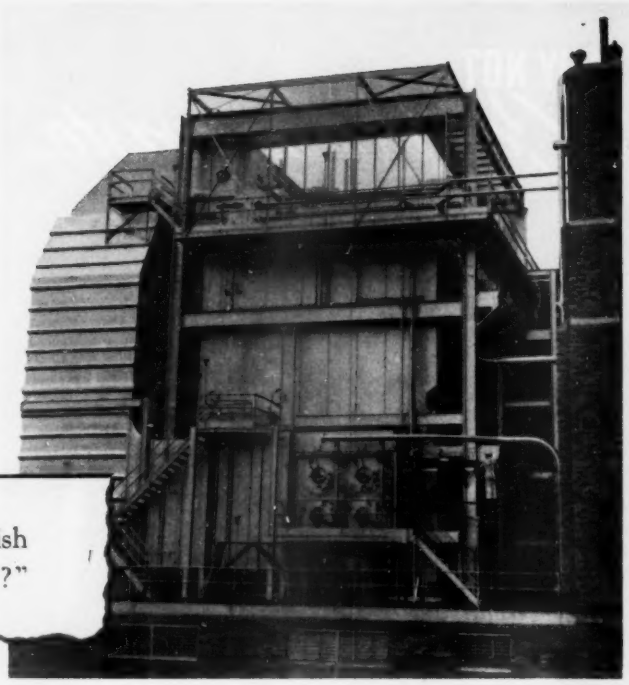
HEAT-TRANSFER COEFFICIENTS IN HORIZONTAL-TUBE EVAPORATORS, *by W L Bryan and G W Quaint, Case Institute of Technology.* Pressure drops and heat-transfer rates in evaporators depend on a number of factors. Studies were made of Freon-11 evaporating inside a smooth horizontal tube with and without a turbulence promoter installed. A correlation of heat transfer vs pressure drop is presented for Freon-11 as well as for previously published data for Freon-12 and water.

For a given weight percentage of feed vaporized, heat-transfer coefficient for evaporating Freon-11 or Freon-12 is directly proportional to nondimensional group used for convection heat transfer. Dimensions of the turbulence promoter are critical. Type of flow that exists in evaporator is an important factor and should be given careful consideration in analysis of similar data. *ASRE paper. No number.*

ULTRAVIOLET AIR DISINFECTION IN ROOM AIR CONDITIONERS, *by L J Buttolph, General Electric Co.* There is an increasing awareness of the air-borne spread of respiratory diseases and the desirability of air sanitation. Air sanitation can add hygienic and psychological values to comfort now provided by standardized temperature and humidity controls of air conditioning.

Cool, disinfected air in crowded spaces is possible with a window unit incorporating an ultraviolet tube. Air-borne bacteria and viruses are readily killed by exposure to ultraviolet energy of wave length 2537A. Although exposure to a low intensity may take hours for killing, air disinfection must be done in one to five minutes, directly in a room in a fraction of a second, with-

WE HAVE BEEN ASKED:



"What is the best finish for an outdoor boiler?"

A letter we received recently stated:

"We plan to install our new boiler outdoors, and we have a question about the best finish to use. The boiler will be insulated with 85% Magnesia Block. What type of finish would you recommend, taking into consideration both cost and durability?"

We advised two coats of Armstrong's Insulmastic as a finish for this boiler because it is less expensive than many other finishes that are suitable for outdoor applications. Also, it does not crack in cold weather or soften in summer's heat and has unusual durability under wind, rain, and snow. It requires only periodic painting with aluminum or Armstrong's No. 3 Asphalt Paint. However, for best results the Insulmastic must be applied properly.

After the Magnesia Block has been installed, a layer of hexagonal mesh should be secured in place, and one coat of asbestos cement troweled on to an even surface. Next, a second layer of mesh is applied over the plaster and two coats of Insulmastic troweled on to a smooth, even finish. Should the boiler be in a busy area where it might be subjected to damage, it's wise to erect bump rails for protection.

Almost every job presents problems that must be well thought out if the insulation is to be truly effective. Armstrong's engineers are ready to help tailor your insulation specifications to meet your requirements. In addition to the advice of highly trained engineers, Armstrong offers a complete Contract Service with skilled workmanship and highest quality materials.

IF YOU HAVE ANY QUESTIONS on the construction of high-temperature or low-temperature equipment, please do not hesitate to write to us. We'll do our best to give you a practical answer. Just address a letter or post card to Armstrong Cork Company, 7002 Maple Avenue, Lancaster, Pennsylvania.

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FOR ALL TEMPERATURES FROM 300°F. BELOW ZERO TO 2800°F.

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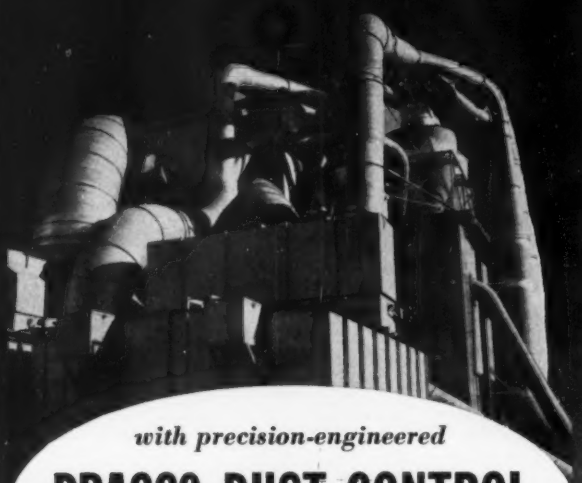
Cash in on waste...



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DRACCO DUST CONTROL

DESIGNED TO YOUR SPECIFIC REQUIREMENTS

Your plant may be one in which machine-damaging dust multiplies maintenance expense and increases production cost. Or it may be that you are wasting valuable basic materials in your manufacturing processes.

In either case DRACCO DUST CONTROL equipment will insure higher operating efficiency in your plant. Designed and constructed specifically to meet your requirements, DRACCO DUST CONTROL will remove all harmful dust and fumes from your plant buildings and recover valuable basic materials.

Thousands of existing DRACCO installations are constantly proving the value of DRACCO precision engineering and construction through their high-efficiency operation and low maintenance cost. DRACCO engineers, with over thirty-five years experience devoted exclusively to dust control, will be glad to analyze your problem and recommend proper equipment.

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DUST CONTROL EQUIPMENT

PNEUMATIC CONVEYORS • METAL FABRICATION

in an air duct or a room air-conditioning unit.

To adequately disinfect air of typical respiratory organisms during the 1/10 to 1/20 second of its travel through the ultraviolet-filled irradiation chamber of a room air-conditioning unit, the average ultraviolet intensity throughout the chamber must be about 2.5 to 5 ultraviolet watts per sq ft. Such intensities can be had within very few inches of the germicidal tubes as set within the confines of room air conditioning units. *ASRE paper. No number.*

ABSORPTION AIR CONDITIONER, *by E P Whitlow and L A McNeely, Servel, Inc.* Underlying principles of absorption refrigeration were recognized in the 18th century. In the air-conditioning field, 3, 5 and 115 to 200 ton absorption units are available. Between these two ranges there is a large vacant area and it was felt that this market should be better served. Talks with architects and contractors showed that 20-ton steam-operated units that could be installed in multiple were desirable. Development of a suitable 20-ton unit was begun.

Because results were good with water-lithium bromide systems it was decided to build the units for water refrigerant and bromide absorbent. This paper describes design procedures and calculations for the unit. *ASRE paper. No number.*

A SURVEY OF HEAT PUMP RESEARCH AND DEVELOPMENT PROJECTS, *by Charles H Coogan,* JR, UNIVERSITY OF CONNECTICUT. Because all firms do not publicize their research and development work it is difficult to ascertain just what progress is being made in a specific field. This was the case in heat-pump studies. So a list of questions was sent to various firms that might be doing research and development in the heat-pump field.

Results of the survey show that over one-third of the projects reported in progress are analytical and the remainder experimental. Roughly the same emphasis is being placed on economic, thermodynamic and mathematical types of analysis. Studies are applicable mainly to residential and commercial units. Although some studies will have a limited area of application, a great many will be applicable anywhere in the U. S. More than one-third are limited to space heating and about the same number are studies entailing a complete unit. Majority of units use air or earth as a heat source or heat sink. About one-third include weather and ground analysis. Units in studies are all 10 kw or less and all use Freon-12 as working substance. *ASRE paper. No number.*

(*Continued on page* 164)

NOW . . . Coppus-Dennis FANMIX Action REVOLUTIONIZES OIL BURNER PERFORMANCE 6 WAYS!

1. **INCREASES BOILER RATINGS** because all of your furnace space is used for combustion . . . none for mixing.

2. **STEPS UP FUEL EFFICIENCY** because complete combustion is guaranteed with 5% to 10% excess air.

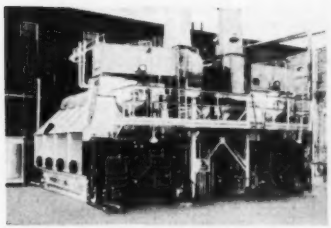
3. **GETS RID OF "HOT SPOTS"** because continuous explosion kills torch action and disperses heat uniformly.

4. **ELIMINATES FORCED DRAFT EQUIPMENT** because FANMIX action itself overcomes the entire draft loss across the burners.

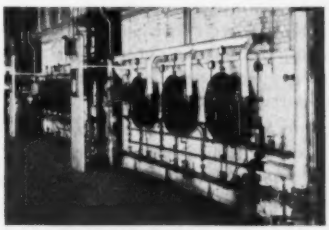
5. **CUTS STACK REQUIREMENTS** because the forced draft created by FANMIX action calls for less furnace draft.

6. **REDUCES COKING OF ATOMIZERS** because their tips are air-cooled by the fan blades to a point well below the coking temperature.

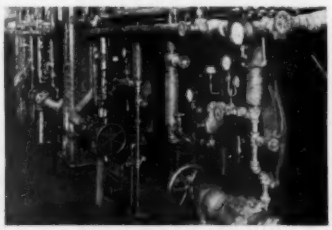
COPPUS-DENNIS FANMIX OIL BURNERS, thoroughly proved in important installations for more than two years, utilize jet reaction of steam-atomized oil to rotate a fan which is an integral part of the burner. Automatically adjusted proportion of high velocity air passes at right angles through the sheet of atomized oil to create an ideal mixture for fast, complete combustion — peak efficiency.



COMMERCIAL SOLVENTS CORP. plant, Terre Haute, Indiana, utilizes Coppus-Dennis FANMIX Oil Burners to fire two fully automatic 250 hp steam generators. Installed early in 1948, these two units have since been supplemented by a third.



AMERICAN WOOLEN CO., in one of its plants, has equipped two 1000 hp boilers with six Coppus-Dennis FANMIX Oil Burners.



BROCKTON EDISON CO. relies on four Coppus-Dennis FANMIX Oil Burners in its plant in East Bridgewater, Mass.

ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT

INVESTIGATE! If you share in the responsibility for the efficiency of your firm's boiler operations, it will pay you to learn why Coppus-Dennis FANMIX Oil Burners, made to Coppus Blue Ribbon standards of quality, promise such superior performance. Send the coupon today.

Please attach this coupon to your company letterhead

COPPUS ENGINEERING CORPORATION
162 Park Avenue
Worcester 2, Mass.

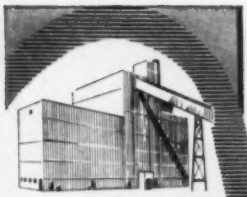
Please send complete data on Coppus-Dennis FANMIX Oil Burners.

Name.....Title.....

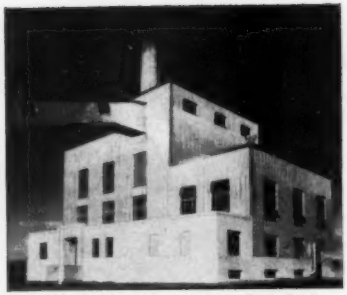
Company.....

Address.....

City.....Zone.....State.....



POWER DIVISION



7500 Kilowatt Electric Plant of Iowa Public Service Company at Storm Lake, completed spring of 1950.

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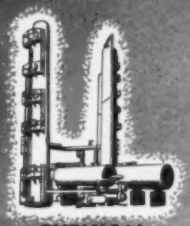
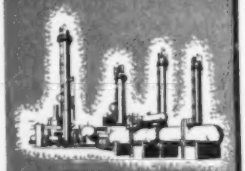


CHEMICAL DIVISION



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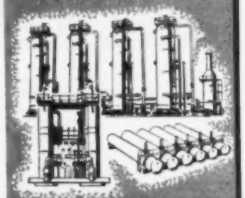

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TECHNICAL BRIEFS

(*Continued from page* 162)

Welding

DEVELOPMENT OF WELDING PROCEDURES FOR HIGH-PRESSURE, HIGH-TEMPERATURE STEAM PIPING, *by N. L. Navarre, U.S. Naval Engineering Experiment Station.* For several years, intensive investigations have been performed to develop procedures for welding various alloy steels considered applicable for superheated steam lines within 950 to 1100 F. The author divides this work into three parts.

Part 1 describes methods to determine the applicable preheat or postheat treatment for selected steels. In addition, several methods are described for measuring residual stresses in tube weldment. These methods are X-ray diffraction, magnetic analysis, and direct relaxation.

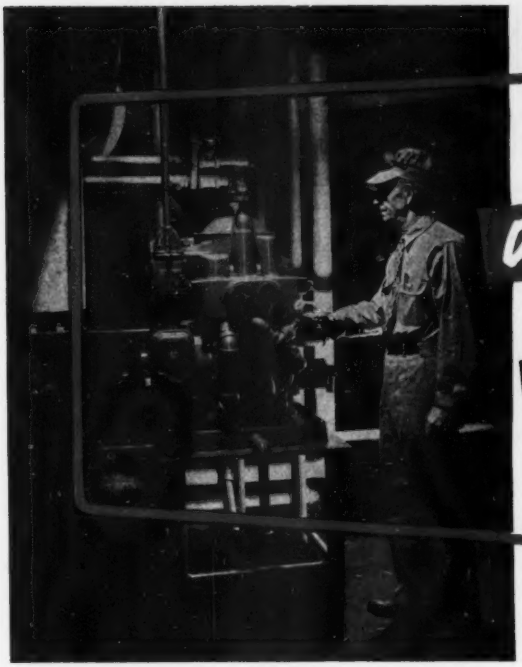
Part 2 covers methods to evaluate existing electrodes and in some cases to develop, in cooperation with industrial producers, new electrodes for intended purposes. This part describes methods to select electrodes and develop procedures for welding austenitic against ferritic tube joints.

Part 3 concerns itself with practical evaluation of data given under the first two parts and pays particular attention to thermal shock testing. *AWS paper. No number.*

WELDING HIGH-PRESSURE, HIGH-TEMPERATURE PIPING, *by H J Irrgang, W K Mitchell & Co.* During the past few years, high-pressure high-temperature pipe fabrication has changed almost daily as far as pressures and temperatures go. So the materials have changed just as frequently. Because they vary considerably in their constituents, methods of fabrication and welding will have to vary.

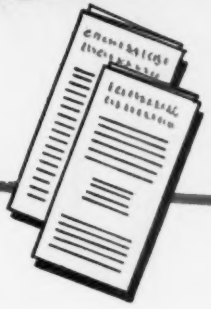
This variation presents quite a problem to the piping contractor because each material differs somewhat in its method of fabrication and welding. The contractor must have on hand equipment and experience to fabricate properly any and all the various materials.

Before starting fabrication on a new material, the contractor must set up a procedure that gives satisfactory results required by codes and specifications for bending, forming and welding. This means the contractor or fabricator must be able to set up in the field the necessary steps to qualify his procedure and yet meet a job schedule. The author describes a possible procedure and stresses the fact that with it the fabricator or contractor may be able to take many shortcuts, but it will have to depend on how soundly trained the operator is in proper welding techniques. *AWS paper. No number.*



At Calco Chemical's Power Plant —

DE LAVAL DOUBLE PROTECTION IS TURBINE LIFE INSURANCE



De Laval Oil Purifiers are especially important at the power plant of Calco Chemical Company, for this great plant is completely independent of outside power. The De Laval centrifugal machines, on continuous by-pass, keep the turbine oil free of both of the chief contaminants that tend to cause trouble —*dirt* and *water*. Since a perfectly-clean lubrication system is the best protection a turbine can have, and since the De Laval machines keep the oil always in a safely clean condition, in truth these centrifugals are a form of "life insurance" for the power plant.

The De Laval centrifugal helps maintain in any oil the properties given it at the refinery. It does not remove oil-soluble additives.

When oil is circulated on continuous by-pass, through De Lavals of proper capacity, it is purified from three to four times daily. The oil never has a chance to become contaminated.

● Write for Bulletin TO-1.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

DE LAVAL for most dependable power production

LUBRICATING OIL PURIFIERS

Get TWICE the value for your steam trap dollar!

Just as the self-starter revolutionized the automobile, so Clark Duo-Step Leverage is changing old-fashioned ideas about steam trap efficiency.

Field and laboratory tests prove that Clark DUO-STEP Steam Traps more than *double* the drainage capacity of ordinary inverted bucket traps.

Ask your Clark representative for a demonstration on your steam lines—or write us for complete information.

Here's how DUO-STEP doubles drainage capacity

THE CLARK MANUFACTURING COMPANY
1831 East 38th St. • Cleveland 14, Ohio

PLANT PROBLEMS

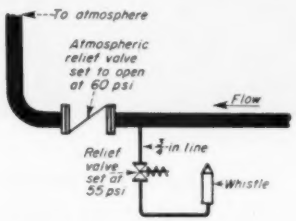
(*Continued from page* 126)

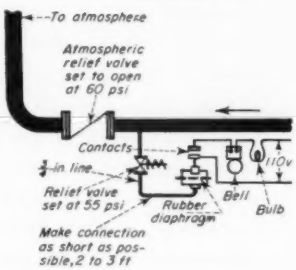
Construct manometer, sketch, p 126. Difference, *D*, between mercury-leg heights is nearly proportional to square of steam flow. With 6-in.-dia orifice and standard ASME "radius taps," this distance is about ¾ in. for 5000 lb per hr, about 3 in. for 10,000 lb per hr, etc. Flowmeter is more convenient but costs more.

If atmospheric relief valve opens a few psi higher than minimum satisfactory process pressure, recording pressure gage on 50-psi line may be helpful. Cost is moderate. Meter shows pressure trend when valve is closed and permits operator to change power and process loads accordingly.

Alarm, on atmospheric relief valve *GH* mentions, gives neither advance warning before steam escapes nor what amount escapes.

ARTHUR HOLT *Atlantic City, N.J.*





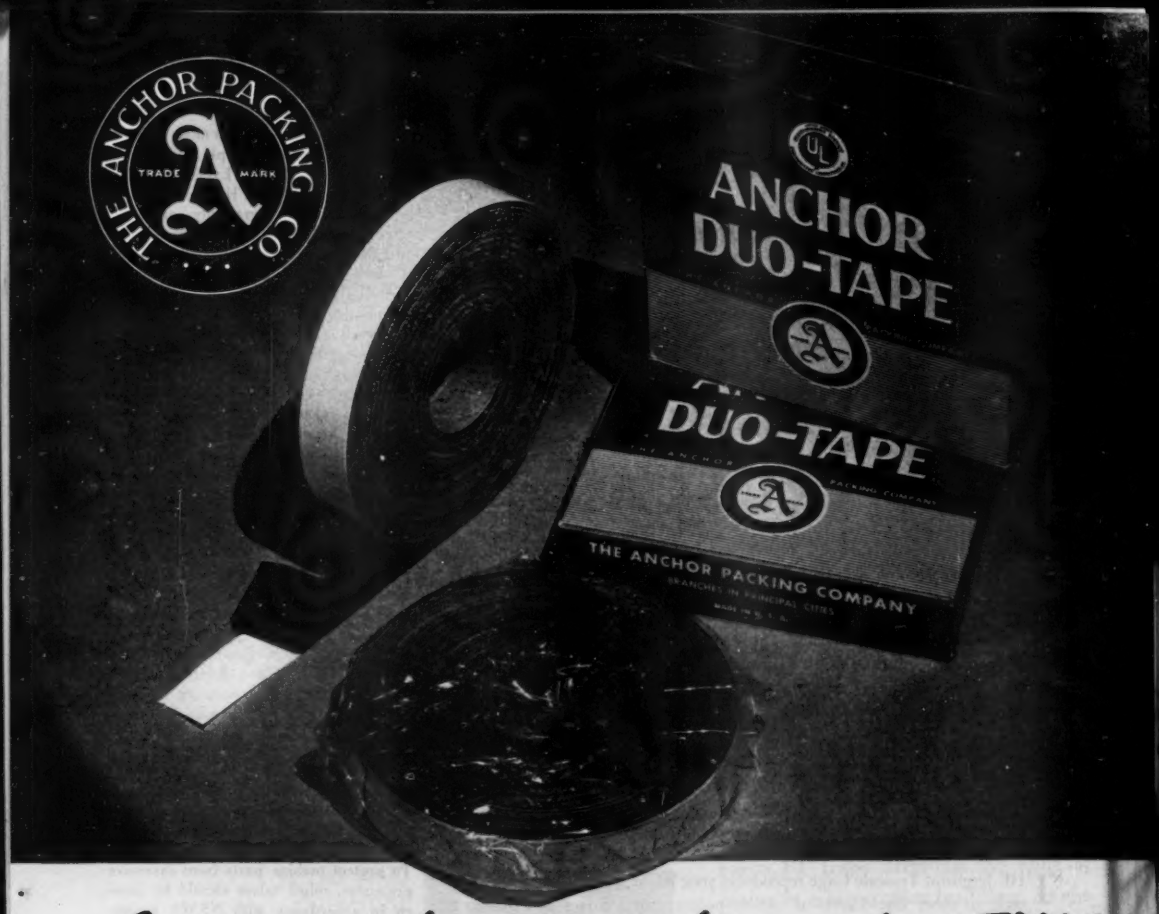
Try Whistle or Bell

IN THE PAPER INDUSTRY we use an alarm that sounds at intermediate pressure between low-pressure main and relief-valve setting. Hookup, upper sketch, allows time for making load corrections to prevent valve from opening. Install whistle and ¾-in. line so they are self-draining back to 1-p steam main.

Where alarm must sound in a room far from relief valve, use electrical set-up in lower sketch. Small relief valve opens at 55 psi and operates diaphragm to close contacts and sound bell or light bulb.

A RODRIGUEZ ULLOA
Mexico City, Mexico

(*Continued on page* 168)



One tape that does the work of TWO

For literally a countless number of uses in plant, shop and home, Anchor Duo-Tape is finding wide favor. This new tape, introduced only two months ago by The Anchor Packing Company, is a multi-purpose tape, having very strong adhesion and the layers will fuse or weld together with slight finger pressure.

Ideal for insulating both inside and outside wiring and in the maintenance and repairing of motors, generators, transformers and similar equipment. Also for repairing rubber hose and tubing, lamp cords, etc. It does the work of two tapes, and only DUO-TAPE is needed. Approved by Underwriters' Laboratories.

Write today for new booklet describing ANCHOR DUO-TAPE fully.

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GENERAL OFFICES: PHILADELPHIA, PA.

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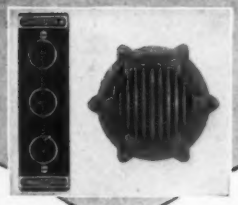
ACCURATE

Liquid Level Readings AT REMOTE POINTS with the JERGUSON TRUSCALE GAGE



Available with Visible and Audible Alarms and Repeaters at auxiliary points.

THE Jerguson Truscale Gage reproduces your boiler water, deaerating tank, or other liquid level at remote points with accuracy as close as ½ of 1%. This is made possible by a design which transmits movement changes in a mercury-filled manometer through a specially designed featherlight pointer system. A unique magnetic coupling, with a magnetically energized yoke operating on precision bearings, uses the maximum of coupling force available with a minimum of inertia in the pointer system.

The extreme sensitivity and close accuracy of the Jerguson Truscale Gage gives you *dependable liquid level readings at remote points.* The Truscale Gage has a built-in adjustment for easy calibration for any W.S.P. The dial is illuminated, the scale markings and pointer glow in the dark, and the gage is available with visible and audible alarms.

Investigate this exceptional remote reading liquid level gage. Write for data unit on Jerguson Truscale Gage.

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Gages and Valves for the Observation of Liquids and Levels

Representatives in Major Cities
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JERGUSON GAGE & VALVE COMPANY
100 Fellsway • Somerville 45, Mass.
European Mfg. Affiliate: Bailey Meters & Controls, Ltd.

Pressure Recorder OK

GH's PROBLEM HAS OCCURRED in many plants where steam supply and demand get out of balance. Excess must be blown to atmosphere. He needs advance warning when oversupply of 50-psi steam exists so he can pick up condensing load and drop backpressure load. Flow needn't be measured; savings result only when flow is reduced to minimum or eliminated entirely.

Install a pressure recorder that indicates and records pressure in 50-psi header. Operator will know at what pressure relief valve opens and can plan his operation by observing rate of pressure change. Pick up condensing load and decrease backpressure load when pressure increases; operation is reversed for pressure decrease.

Inexpensive alternative uses pressure switch in 50-psi header to sound alarm at some pressure slightly less than that at which relief valve opens. Operator changes load when alarm rings.

Large installations use exhaust-pressure regulators on backpressure turbines. Regulators control steam flow and load to produce desired exhaust pressure. Speed governors on the condensing turbines then handle all resulting load swings.

C A GIESE *New Martinsville, W. Va.*

EDITOR'S NOTE: National Electrical Manufacturers Association has a set of recommended practices for turbine-generators, including their relief valves. To protect turbine parts from excessive pressures, relief valves should be chosen in accordance with NEMA recommendations. Free flow to relief valve should be permitted at all times. So before using any suggestions here be sure to check with NEMA and turbine manufacturer so turbine parts are not endangered.

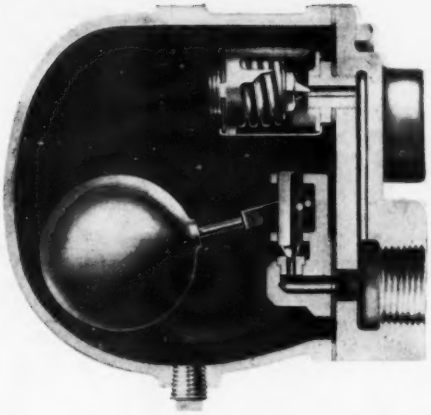
BOOKSHELF

(*Continued from page* 140)

Because of ever-increasing manufacturing costs, management engineers are faced with many difficult problems. These are treated under basic industrial costs, elements of supervision, work simplification, incentive wage methods, job-evaluation plans and fundamentals of good plant management.

In every industrial plant and institution one of the most important production functions is refrigeration, heat, air conditioning, compressed air, water and other services and their applications. If these fail all other operations do also. The authors emphasize this by devoting nearly two-thirds of the book to subjects related to providing the sinews of production. These include power-plant engineering and operation, refrigeration, process air conditioning, electric power distribution, mechanical

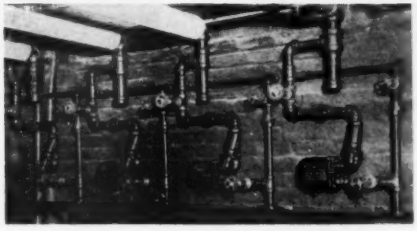
(*Continued on page* 202)



SARCO

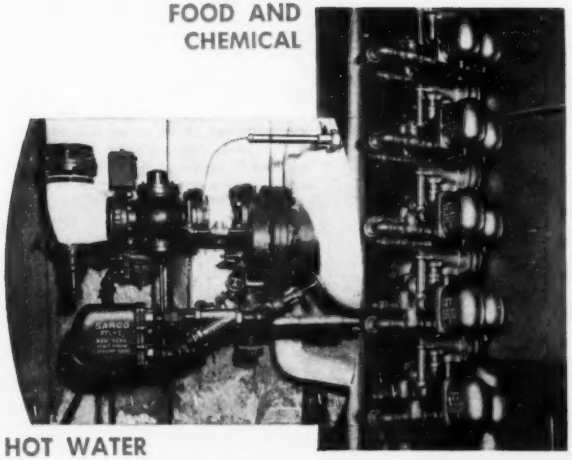
FLOAT-THERMOSTATIC STEAM TRAP

For Continuous Condensate Removal



HEATING MAINS

FOOD AND CHEMICAL



HOT WATER

Here is the trap that is used by the thousands for heating coils, mains and continuous process operations. The built-in automatic thermostatic by-pass takes care of all air and gases without steam waste.

The top illustration shows a bank of Sarco FT traps dripping the ends of mains in a large office building. At the left is shown a typical installation. In the soap and food industries, in two Chicago plants, a few Sarco FT's made a million dollars worth of equipment operative where three other types of traps had failed.

The controlled hot water hook-up at the lower left is another example. The ball float in the FT trap allows continuous discharge without shock to temperature controls. Ask for Catalog No. 450.

316

SARCO SAVES STEAM

SARCO COMPANY, INC.

Represented in Principal Cities

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SARCO CANADA, LTD., TORONTO 8, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT

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The Fairmont Coal Bureau's cooperative market development program has reduced steam costs in many plants, for example:

Plant "A" producing 35,000 lbs. of steam per hour—fuel savings $41,300.00 per year.

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Fairmont Coal Bureau engineers have the facts and figures on hundreds of plants. This "Know-how" applied to your problem might result in savings similar to the case histories shown above. Mail coupon below today, or give us details on your particular steam production problem.

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Kindly place me on your mailing list to receive copies of your publications and Technical Reference Bulletins.

P-2-51

Name _____ Company _____

Position _____ Nature of Business _____

Address _____ City _____ Zone _____ State _____

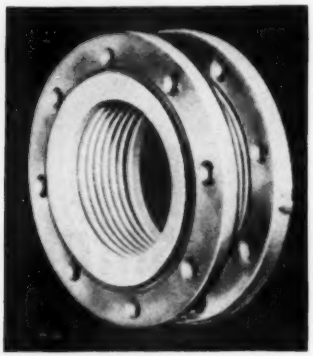
EQUIPMENT NEWS

(*Continued from page* 148)

cushion of neoprene rubber. All belts have a special bonded edge, which prevents fraying.

Baldwin Belting, Inc, 74-76 Murray St, New York 7, N. Y.

For more data on these items, use post cards, p 188a. Identify request with P and number.



EXPANSION JOINTS **P248**

For use where thermal expansion, vibration, misalignment or other conditions demand a flexible chemicalproof piping section. *Chemiseal* Teflon expansion joints are normally supplied with integrally-gasketed flanges drilled to 150-lb ASME standard. Joints are designed for 25-psi pressure at temperatures from −150 to 400 F. Being solid Teflon they can neither be attacked by nor contaminate any known chemical used commercially.

Teflon Products Div, United States Gasket Co, PO Box 93, Camden, N. J.

CHROME-PLATING UNIT **P245**

Normal life of most cutting tools and wear parts can be multiplied 3 to 10 times by this hard chrome-plating finish. *Chromaster* will hard-chrome-plate surfaces up to 10-sq inches at current density of 2-amp per sq in. Using this process, ½ minute is the average time required to plate cutting tools and wear parts.

Ward Leonard Electric Co, Mount Vernon, N. Y.

MULTIPURPOSE GREASE **P239**

Oxidation inhibited *Cosmolube* is suitable for about all types of installations—wet, dry or cold. This one grease follows the general trend throughout the industry of providing one grease that does many jobs.

E F Houghton & Co, 303 W Lehigh Ave, Philadelphia 33, Pa.

WELDING ELECTRODE **P222**

Thoriated tungsten, long used in electronic tubes because of its excellent electro-emission characteristics, is now available as a nonconsumable electrode, *Thor-Tung* for *Heliwelding*, Airco's inert gas shielded dc straight polarity arc-welding process. *Thor-Tung* operates much cooler than standard tungsten electrodes, permitting higher current on given size elec-

"Piping by Midwest" means the very best in piping at lower completed cost. Being accurate in dimension and alignment, Midwest subassemblies are easy to erect . . . difficult operations are performed in our fabricating plants and field work is simplified. When desired, Midwest will also erect the piping with undivided responsibility. You will find it to your advantage to call on Midwest whenever you need piping.

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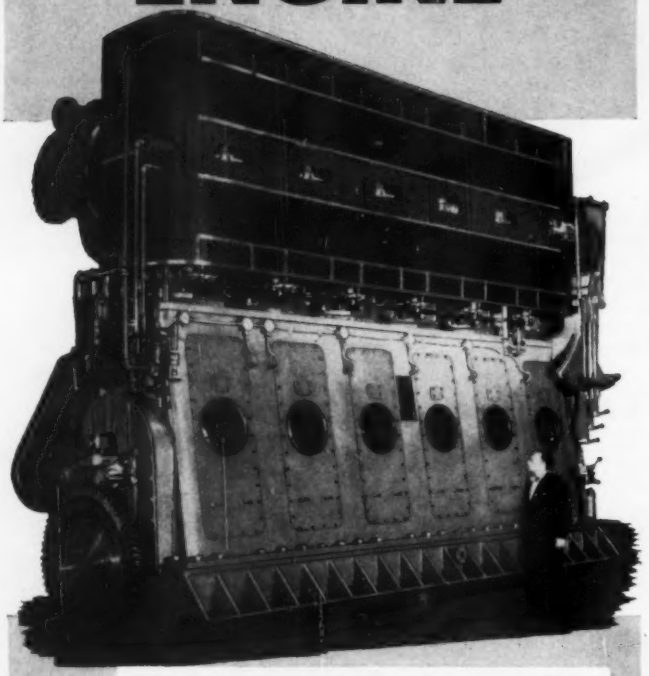
PIPING FABRICATORS AND CONTRACTORS

4 Plants Are Better Than 1

4194

The 12,000th SKINNER ENGINE



This is the 12,000th Skinner engine! It was built for marine service, and is a 23-inch bore x 26-inch stroke, 6-cylinder SKINNER MARINE UNAFLOW STEAM ENGINE. While it is not the largest Skinner Engine ever built, it has a conservative rating of 4000-hp.

For over 80 years SKINNER ENGINES, installed in almost every known industry, have been giving dependable, economical performance in generating electrical power and driving blowers, compressors, refrigeration equipment, pumps and other loads.

In the marine field they have proven their dependability, maneuverability and economy in peace and wartime service, on ocean, river and lake, as the propulsion units of tugs, passenger and railway car ferries, dredges, tankers, bulk carriers, ice breakers, aircraft carriers and express cargo vessels.

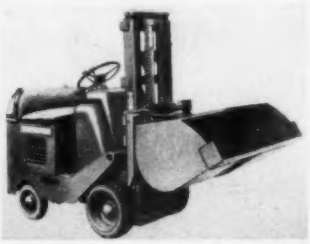
For Over 80 Years, Doing One Thing Well—Building Steam Engines

SKINNER ENGINE COMPANY, ERIE, PA.

trodes at greater arc stability and lower current. Because of its permanency, this welding rod may be pointed to permit continued operation at extremely low current.

Air Reduction Co, 60 E 42nd St, New York 17, N. Y.

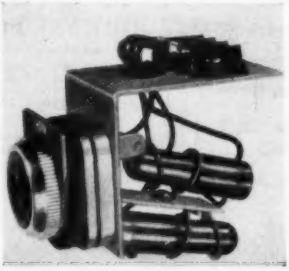
For more data on these items, use post cards, p 188a. Identify request with P and number.



LIFT-TRUCK SCOOP **P211**

Hydraulic scoop picks up, transports and dumps bulk materials such as coal, sand, cement, scrap, etc. Actuated by a 2-way hydraulic cylinder, the scoop has fingertip control with the lift truck's mast in vertical position. The hydraulic scoop will tip 45 deg forward for dumping the load and 30 deg backward for carrying it. With full-open throttle, the scoop can be dumped from the carry position in 1 to 3 sec, depending on the unit's size.

Towmotor Corp, 1226 East 152nd St, Cleveland 10, Ohio.



MERCURY SWITCH **P241**

Suitable for hazardous, explosive locations this mercury switch is furnished with either pushbutton or selector knob. Mercury switch is hermetically sealed and mounted on a lever-operated armature.

Switch is designed for vertical panel mounting. Furnished as a single-pole switch with either single- or double-throw action.

Panalarm Products Inc, 7212 No. Clark St, Chicago 26, Ill.

CIRCLE-SEAL CHECK VALVE P203

Check valve uses synthetic-rubber O-ring to seal between conical surfaces on the poppet and valve housing. As line pressure on the outside of the O-ring increases, it increases the sealing pressure. The O-ring seals only the valve, the poppet being carried by a metal shoulder in the valve housing. When open, fluid flows around the streamlined poppet, giving the valve good flow characteristics and low pressure drop. The spring retainer, which

Jeffrey Spiral Conveyor shown here is handling lime and alum in a large Water Works plant. Note the clamped cover used when dusty material is encountered . . . also the various rack and pinion valves in trough bottom for delivery of material when and where needed. A spiral flight is shown also.

THE SPIRAL CONVEYOR IS A COMPACT UNIT

You can save time and money by using a Jeffrey Spiral Conveyor. A neat and compact installation — no return strand. Capacities vary with size of conveyor. Handles many kinds of material at low cost.

Sectional, Flight, Helicoid, Mixer, Cut Flight, Ribbon and Cast Iron . . . six types manufactured by modern methods with equipment especially designed for the purpose. Uniform strength, perfect fit and true alignment assured.

Jeffrey Spirals are interchangeable with other standard makes . . . are built to industrial standards. Try one on your next handling job whether it's coal, raw sugar, grain, salt cake, cement, carbon black, grape fruit or orange rinds, etc.

Catalog No. 803 fully describes and pictures Jeffrey Spiral Conveyors. Send for it today.

THE JEFFREY MANUFACTURING COMPANY

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Complete Line of Material Handling, Processing and Mining Equipment

932 North Fourth St., Columbus 16, Ohio

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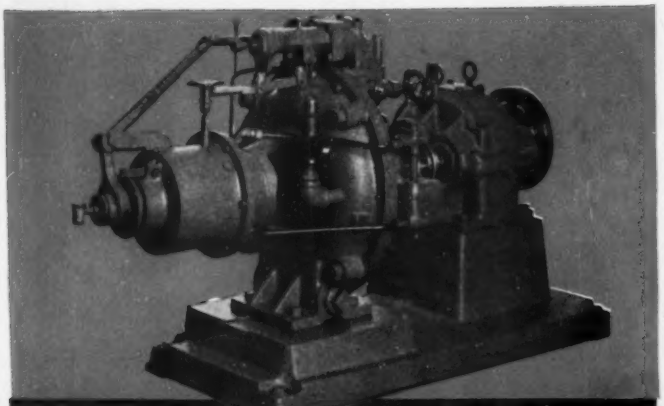
Jeffrey Mfg. Co. Ltd., Montreal, Canada
Jeffrey-Galion (Pty.) Ltd., Johannesburg, S. A.
The Ohio Malleable Iron Co., Columbus, Ohio
British Jeffrey-Diamond Ltd., Wakefield, England
The Galion Iron Works & Mfg. Co., Galion, Ohio
The Kilbourne & Jacobs Mfg. Co., Columbus, Ohio



Wing Turbines as an Alternate Source of Auxiliary Drive

The use of turbines as an alternate source of auxiliary drive is good business in these days of urgent production and uncertain industrial conditions. When electric motor drive is subject to power failures due to strikes, fires, floods, hurricanes (or bomb attack), the ability to continue with steam auxiliaries is an advantage that is worth many times the cost of the alternate equipment. And the use of Wing Steam Turbines for such services as pumps, compressors, fans, blowers, generators, etc., can cut power costs by acting as a reducing valve on boiler steam for use in process and heating.

L. J. Wing Mfg. Co.

50 Vreeland Mills Road, Linden, N.J.

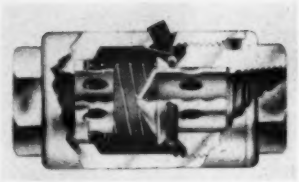
Canadian Factory: Montreal, Canada

Write for a copy of Bulletin SW-50

WING

Wing

AUXILIARY TURBINES

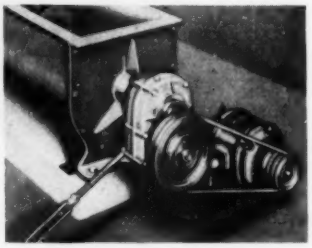


serves as a poppet stop, has ample ports of full flow even under surge conditions.

Valves are available in full range of sizes from ⅛ to 1 in. They open on pressures as low as 1-psi differential in the standard-pressure types, and 4 in. of water in the low-pressure types. Poppets close at zero flow before reverse flow starts.

John-Pond-Clark, Pasadena, Calif.

For more data on these items, use post cards, p 188a. Identify request with P and number.



SPEED REDUCER **P207**

A torque-arm reducer for output of 115 to 330 rpm is made in four sizes for capacities up to 27 hp. It can be mounted on the driven shaft to eliminate special engineering, cost of foundation, flexible coupling, sliding base, and lining up.

Unit is locked by two steel locking collars to the drive shaft. It is anchored to the floor or any other fixed object by the torque-arm. Reducer can be driven through any V-belt or flat belt. Any required output speed within the recommended range can be obtained with stock sheaves. Accurate adjustment of belt tension is made easily by operating the turnbuckle in the torque-arm.

Dodge Mfg Corp, Mishawaka, Ind.

TROUBLE SIGNAL **P242**

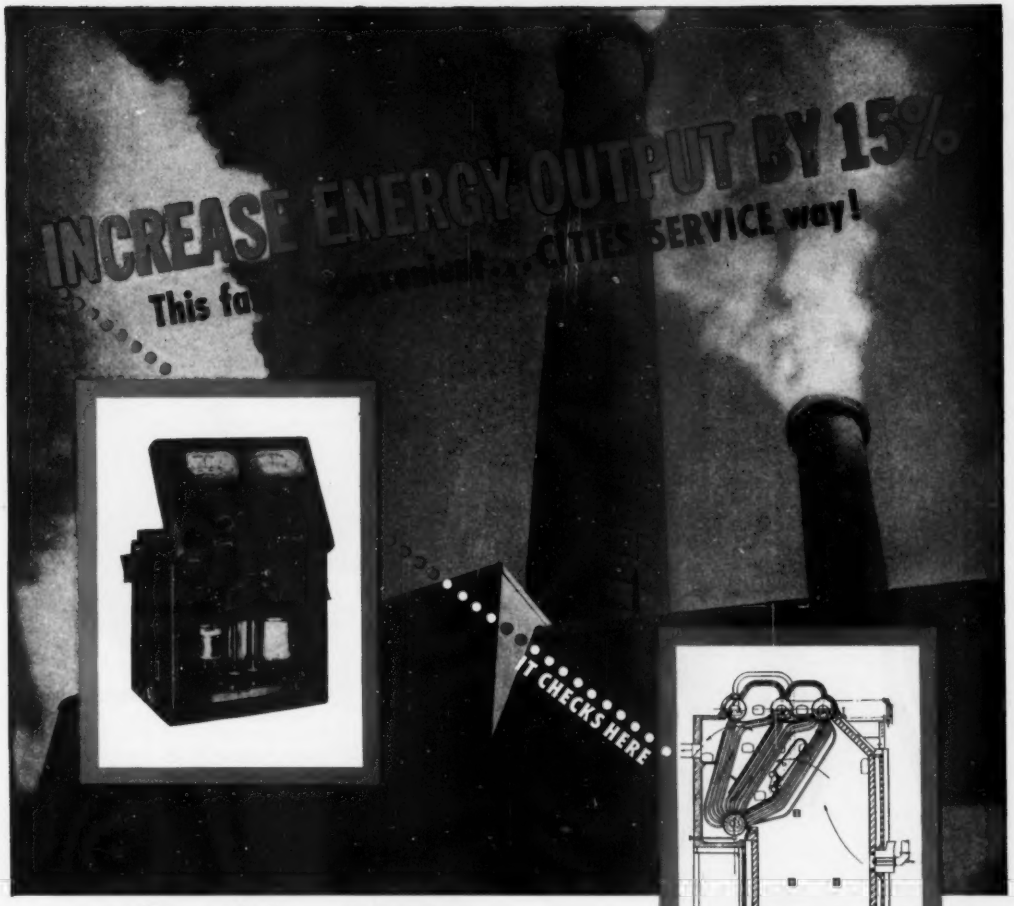
A back-lighted multiple-unit signal that's suitable as a trouble signal in process industries and power plants. Device is hermetically sealed conforming to Code regulations for Class 1, Division 2 specifications.

Signal lights and relay are combined in a single sealed container. Unit plugs into a universal chassis. Designation plates for each signal are either printed or engraved according to customer's specifications.

Panalarm Products Co, 7218 N. Clark Street, Chicago 26, Ill.

ELEVATOR ROLLER HOLDBACK **P214**

A normal-duty roller-type holdback is designed to prevent reversal of inclined conveyors and bucket elevators when power is interrupted. A hardened steel roller floats



The Cities Service Industrial Heat Prover

This remarkable instrument is an exhaust gas analyzer, designed for use on industrial furnaces regardless of size or type. It is provided with three scales; one shows per cent of oxygen, another percentage of combustibles present and measured in the flue gas sample, and the third scale registers flue gas temperature.

A fuel analysis taken at this important checking point—during a free demonstration—has led to increases in energy output as high as 15%. The Heat Prover indicates the type of adjustments necessary to get maximum combustion efficiency.

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QUALITY PETROLEUM PRODUCTS

FREE—THIS HELPFUL BOOKLET

CITIES SERVICE OIL COMPANY
Sixty Wall Tower, Room 976
New York 5, N. Y.

Please send me without obligation your new booklet entitled, "Combustion Control for Industry."

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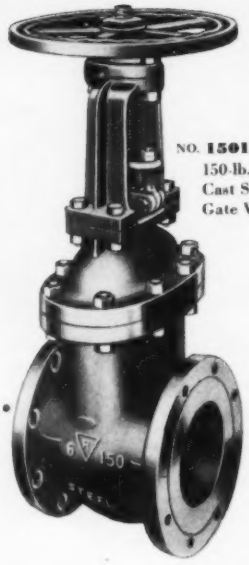
R·P&C
VALVES



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150-lb.
Cast Steel
Gate Valve

Throughout Industry—It's R-P&C for Quality Cast Steel Valves

- R-P&C Cast Steel Valves are on the job throughout industry helping to maintain uninterrupted production with their long and trouble-free service.
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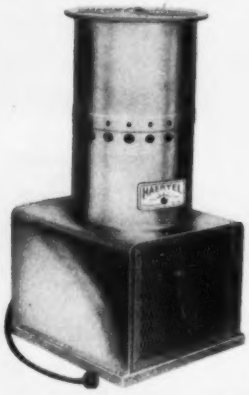
AMERICAN CHAIN & CABLE

"Intentionally Better"
READING-PRATT & CADY VALVES

between a wedge plate and a drum keyed to the head shaft. When direction of rotation of head shaft starts to reverse, because of power failure, the hardened steel roller is immediately wedged between the drum and the plate to stop motion gently and without shock. When power is reapplied the holdback releases immediately.

Stephens-Adamson Mfg Co, Aurora, Ill.

For more data on these items, use post cards, p 188a. Identify request with P and number.



INDUSTRIAL DEHUMIDIFIER P228

Hermetically sealed ½-hp Freon condensing unit features commercial and industrial dehumidifier 50, which has a maximum 24-hr capacity of 50 lb of water removal from air. Unit will remove 1 gal of water from storerooms or other closed spaces in four to five hours under average temperature and relative humidity conditions.

Walter Haertel Co, 2840-4 Ave. S, Minneapolis, Minn.

DUST COLLECTOR P221

Portable, compact 20x30-in. floor space, standard unit available from stock, Model 8N50 dust collector has a self-clearing paddle-wheel fan direct driven by ¾-hp motor. It is capable of clearing lint, strings from buffing, chips, shaving and sawdust. Dust-laden air enters unit at 5-in. diameter inlet. Dust, dirt, etc, are taken out in cyclone separator and deposited in dust-storage compartment 9x20x28 in., comprising the base of the unit.

Aget-Detroit Co, Ann Arbor, Mich.

PORTABLE HEATER P223

Complete heating unit, including fuel tank, mounts on easy-operating truck. The heater is one of the line of Thermoblocs. Heaters are available from 300,000 Btu output to 100,000 and 200,000 Btu.

Thermobloc Div, Prat-Daniel Corp, East Portchester, Conn.

ELEVATOR BUCKETS P208

Cast integrally with a single link of chain, buckets on elevator cannot loosen and fall off. They are easy to replace, costing no more than a bucket with single

E-M Hi-Fuse metal-enclosed control, using current limiting fuses and polarized field frequency control, provides all-around protection for the big motors. From left to right, two incoming line panels, two induction motor starters, one future control, and four synchronous motor controls.

How Parke-Davis protects the men and motors that produce the germ killer... *Chloromycetin*

THE new Detroit plant of Parke-Davis producing Chloromycetin is one of the world's most modern manufacturing laboratories.

To guard the big, high-voltage motor equipment that drives the compressors for process air and refrigeration, Parke-Davis engineers use six E-M Hi-Fuse Motor Controls . . . the most economical answer to complete protection of men and equipment.

Controlling four E-M 250 HP Synchronous Motors and two E-M 250 HP Induction Motors, these 4800 volt Hi-Fuse Controls can interrupt high magnitude short circuit currents, should they occur, up to 250,000 kva within one-half cycle . . . well before there is any possibility of damage to the motor and control equipment.

With complete overload and undervoltage protection, motor isolating disconnects, and the simple, precise polarized field frequency starting system for the synchronous motors, these E-M controls fully meet all safety requirements.

Personnel get maximum safety, too . . . because the cabinets are metal enclosed, with high and low voltage compartments segregated.

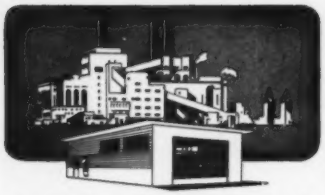
Learn how you can protect men and motors, and modernize your high voltage motor control system with E-M Hi-Fuse Controls. Call, write or wire your nearest E-M engineer for full information, or write the factory for Bulletin 192.

ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA

The polarized field frequency relay, developed by E-M engineers, is a masterpiece of design simplicity . . . no complicated mechanism to maintain or break down. PFFR applies field excitation at precisely the right speed to give smooth, correct and totally automatic synchronization.

3100-TPA-2083

E-M
HI-FUSE MOTOR CONTROLS
COMPLETE PROTECTION FOR MEN AND MOTORS



Industrial Sound Control

QUIETS POWER PLANTS

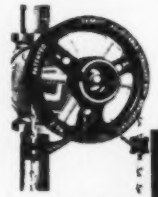
ENDS ANNOYANCE COMPLAINTS
LOW EMPLOYEE MORALE
THREATS OF LEGAL ACTION
Due to Disturbing NOISE

Whether your equipment serves a city of millions, a small town, or just your own plant, ISC can solve the noise problem quickly and inexpensively. Investigate today.

Write, wire or phone us for full information on your problem

INDUSTRIAL SOUND CONTROL
43 Granby St., Hartford, Conn.

Overhead Valves EASILY, QUICKLY AND SAFELY controlled from the FLOOR!



Babbitt *Adjustable* SPROCKET RIM *with Chain Guide*

• Range of 10 adjustable sizes takes care of all valve makes and types; fits valve wheel diameters from 2 to 30 inches.

• No more climbing up treacherous step-ladders, on benches, machines or boilers. High-up, inaccessible valves are brought down to earth by the inexpensive BABBITT Adjustable Sprocket Rim with Chain Guide. Here's overhead valve control that is just as positive as direct manual control, and 100% safer—right from the floor!

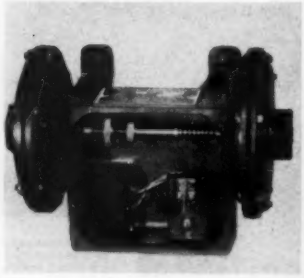
• The BABBITT Adjustable Rim fits all valves, with either rising or non-rising stems. It is installed quickly by clamping onto the hand wheel of the valve.

• *Write today for Catalog Bulletin P, surprisingly low prices, and name of nearest distributor.*

BABBITT STEAM SPECIALTY CO.
1 Babbitt Square, New Bedford, Mass.

link of chain. There are no raised surfaces or projecting bolt heads on inside of bucket to retard discharge of material. Made of heat-treated alloy steel the bucket's front edge and corners are reinforced to withstand severe abrasive action while loading. The flat bottom prevents arching. It is made in five sizes, 8x5, 10x6, 12x7, 14x7 and 16x8 in. Other sizes can be furnished to meet requirements.

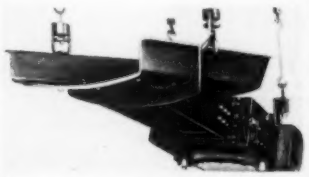
Beaumont Birch Co, 1505 Race St, Philadelphia 2, Pa.



VACUUM CONTROL **P235**

Airtight on both vacuum and pressure side of diaphragm, the 111-D differential pressure or vacuum control has numerous applications where it is necessary to regulate pressure between two vessels and where no leak path between diaphragm and atmosphere can be tolerated. Units are small, obtainable in standard ratings from 0 to 20 in. of water pressure or vacuum with range adjustment and fixed differentials from 0.2 to 2.0 in. of water.

Coral Designs Div, Henry G Dietz Co, 12-16 Astoria Blvd, Long Island City 2, N. Y.



DUST-TIGHT FEEDERS **P212**

Heavy-duty vibratory feeders have their working parts, leaf springs, armature and core covered by gasket-sealed plates bolted to the magnet casting to make them dust-proof. Enclosing these parts protects against clogging by hopper spillage or heavy dust conditions and makes the feeder suitable for Class 2 group installations. Adding this sealed protection does not affect the feed rate, which ranges up to hundreds of tons per hour of bulk, dry or damp, hot or cold, fine or coarse materials.

Syntron Co, 492 Lexington Ave, Homer City, Pa.

WATER DEIONIZER **P217**

Single-tank deionizer brings high-quality deionized water within range of those who have found cost of evaporated or distilled water prohibitive. Unit produces high-quality mineral-free water almost completely free of silica and CO_2. Final specific re-

NOW CLEAN *GENERATORS MOTORS* **Without Solvents**

NO Drying Period Toxic Hazards

with New Pangborn AC-4 Blast Machine

NOW YOU CAN clean electric motors, generators and turbines *without solvents!* The new Pangborn AC-4 Blast Machine scours armatures, parts, frames, coils, etc. with soft (20-mesh) corncob grits.

Since no liquids are used there is no need for drying periods and toxic or explosive hazards are eliminated. Large equipment can be cleaned *in place* and no residue is left to create gum or to break down insulation.

Simple and Inexpensive

New Pangborn AC-4 Blast Machines operate from a standard 40-pound air supply. Material costs average 1/10 of other methods and complete cleaning is finished in half the time.

FOR DETAILS, write today outlining your operation. Address: PANGBORN CORPORATION, 90 Pangborn Blvd., Hagerstown, Maryland.

Look to Pangborn for the Latest Developments in Blast Cleaning and Dust Control Equipment

Pangborn
BLAST CLEANS CHEAPER with the right equipment for every job

How TIMKEN® bearings in Gyrol Fluid Drive keep power flowing smoothly

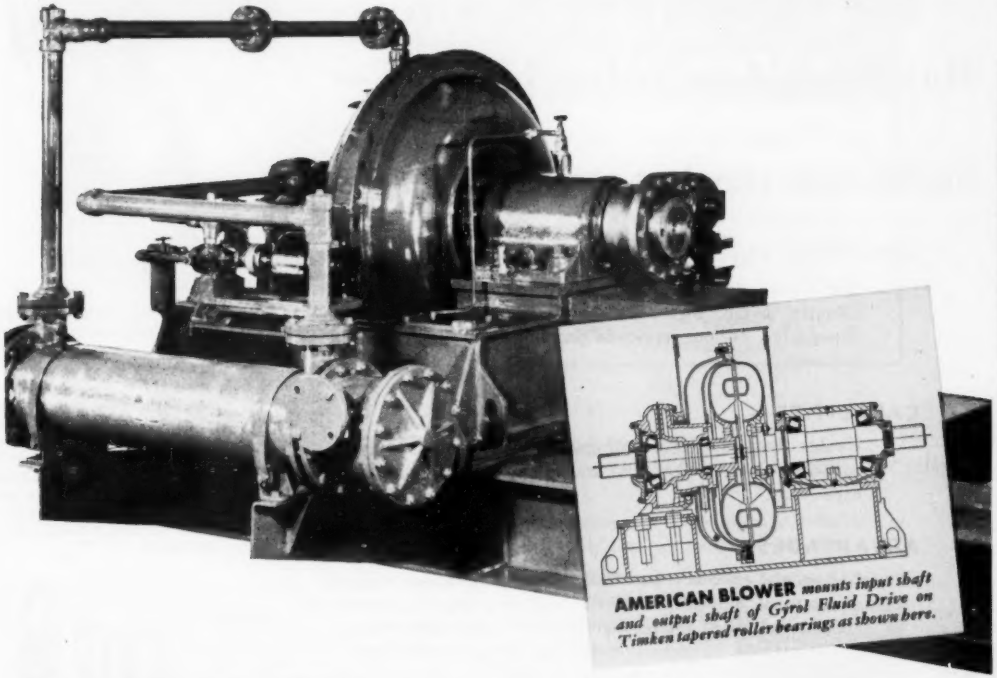
BECAUSE the American Blower Gyrol Fluid Drive shown below is used for driving fans in steel mills and power plants, it must be able to operate continuously, with minimum time-out for maintenance. That's one reason why the American Blower mounts both the input shaft and output shaft on Timken® tapered roller bearings.

Because of tapered design, Timken bearings take both radial and thrust loads; rotating parts are held in proper alignment, reducing wear. Timken bearing rollers and races have a case-hardened outer surface with a tough inner core, with the result that they stand up under the toughest service, rarely requiring any attention beyond lubrication.

And because of their smooth surface finish and true-rolling motion, Timken bearings reduce power loss to a minimum.

Timken bearings in the machines you build are a valuable sales feature. And when you buy machinery the "Timken Bearing Equipped" label is your assurance of long life and dependable performance. Remember, the trade-mark "Timken" on a bearing is your guarantee of top value. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



AMERICAN BLOWER *mounts input shaft and output shaft of Gyrol Fluid Drive on Timken tapered roller bearings as shown here.*

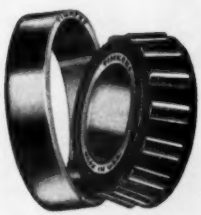
NEW ENGINEERING JOURNAL OFFERED!

529 PAGES! Includes new, technical information on bearing applications available nowhere else. Especially helpful to design engineers. Gives bearing dimensions, capacities, selection and mounting data. For a copy, write on your company letterhead to The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ◎ AND THRUST ⟷ LOADS OR ANY COMBINATION ✳

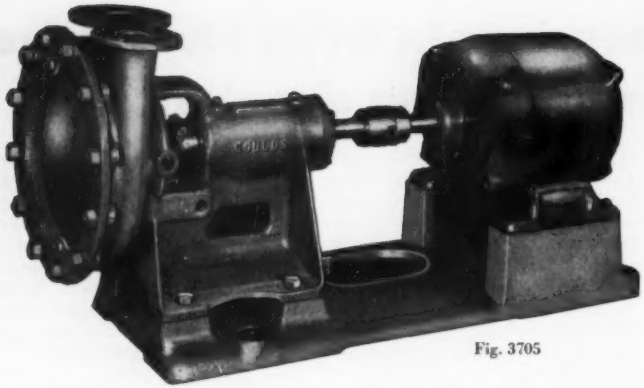


Fig. 3705

For Outstanding Service Handling Corrosive Liquids—

Goulds new stainless steel centrifugals

ADVANCED PUMP DESIGN--

The Goulds 3705 stainless line represents the last word in effective design. Fig. 3705 pumps will give you efficient, dependable, 24-hour service in handling corrosive liquids—at low cost.

CAPACITIES—

Goulds stainless steel centrifugals are made in 8 sizes with capacities to 750 G.P.M. and heads to 180 ft. depending upon capacity.

ADVANTAGES—

Exceptional efficiency (see Bulletin for performance curves) plus extreme simplicity make this an ideal pump for corrosive applications. High interchangeability of parts cuts stocking problem. Quick inspection or cleaning—simply remove casing cover without disturbing pipe connections.

MEMBER

Write for Bulletin 725.3 for complete details on this new stainless steel pump.

Goulds PUMPS INC.
Seneca Falls
New York

sistance is above 5 million ohms—from 10 to 100 times greater than that of most distilled water.

Two types of resinous zeolite exchangers are used in the deionizer. One has positively charged ions called cations, and the other negatively charged ions known as anions. The cation exchanger is regenerated by dilute acid; the anion exchanger by caustic. The two exchangers intermix in a single tank. Because they have a marked difference in density from each other, they can be divided by backwash into two zones for separate regeneration.

Elgin Softener Corp, Elgin, Ill.

For more data on these items, use post cards, p 188a. Identify request with P and number.

STEAM, AIR SEPARATORS P252

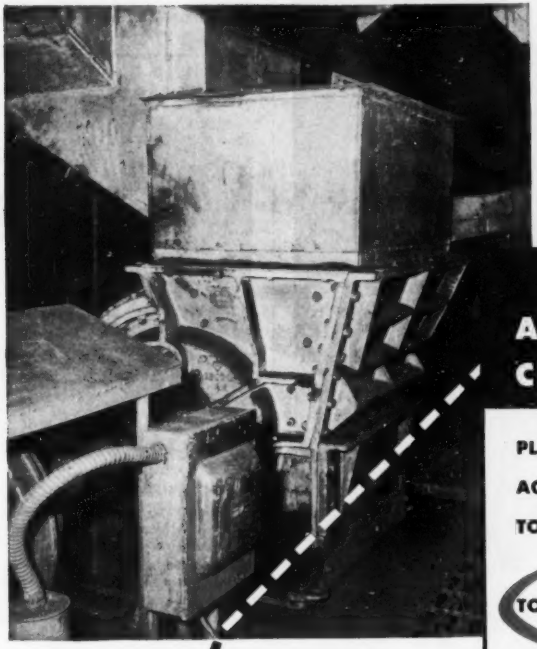
Suitable for separating unwanted liquids and solids from steam, air or vapors under pressure or vacuum, sizes of these units range from 1½ to 24 in. For 50, 125 and 250 psi steam, high-tensile cast iron is used in separator construction; cast carbon steel for 150, 300, 400 and 600 psi steam, ASA standard. Separation takes place with very little pressure drop. Available in both horizontal and vertical styles, units are also made of steel plate on special order. **The Swartwout Co, 18511 Euclid Ave, Cleveland 12, Ohio**

AUTOMATIC EXIT LIGHT P243

This automatic emergency exit light will help people find their way out should the regular source of current fail. Under normal conditions the unit operates in the same manner as a regular exit light.

But if the regular source of power fails, this unit will operate immediately from power furnished by batteries within the fixture. Emergency unit also furnishes a powerful downward beam to light the

These "CRUSHING" FACTS



Another
American Crusher
CASE HISTORY

PLACE: Illinois Coal Mine

AGE OF CRUSHER: 14 years

TOTAL TONNAGE CRUSHED: 1,472,805

TOTAL COST PER TON: one half of 1¢*

again prove
AMERICAN CRUSHER performance

* The total cost figure for the 14-year coal crushing operations of the Illinois coal mine, whose American Crusher record is shown above, includes: original cost of crusher (completely depreciated); plus cost of replacement parts; plus maintenance costs; plus interest on original investment (at 3% for 14 years).

But here is the really significant fact: an independent survey of users of American equipment has shown that this performance record is a typical one for Americans—a consistent pattern of high tonnage reduction at remarkably low parts-replacement cost.

Only such features as the exclusive Crushing Ring Design — originated and perfected by American — could reduce coal in power plants and coal mines across the country year after year, ton after ton, for *less than 1¢ per ton.*

Find out how you may reduce the cost of your own crushing problems.
WRITE for detailed information and illustrated literature.

American PULVERIZER COMPANY

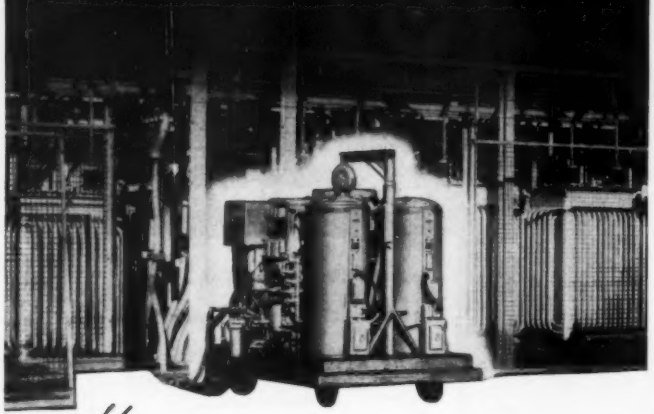
Originators and Manufacturers of
Ring Crushers and Pulverizers

1349 Macklind Ave.
St. Louis 10, Mo.

Eliminate SHUT-DOWNS and EXPENSIVE REPAIRS

on Transformers, Turbines and Diesel Engines

with HONAN-CRANE Oil Purification Equipment



Many leading utilities such as Detroit Edison, Ohio Public Service Co., Pennsylvania Power, etc., have standardized on Honan-Crane oil purification equipment for removal of damaging contamination from insulating, Turbine and Diesel oils.

Honan-Crane can give you exact equipment to do the job. Equipment that will remove all types of oil contamination.

In every installation Honan-Crane equipment quickly pays for itself out of savings in oil and maintenance costs.

● **Write today for Honan-Crane Bulletins: "Purification of Insulating Oils", "Purification of Turbine Oils".**

FOR TRANSFORMER INSULATING OILS

Houdaille Purivac (Shown Above)

A complete automatic system for purifying, dehydrating and degasifying insulating oil in the field or at a central location. For large volume purification requirements.

Honan-Crane "R" Type Purifier

Mobile oil reconditioning unit for centralized batch purification. Ideal for volumes of oil requiring capacities up to 200 GPM.

FOR TURBINE AND DIESEL OILS

Honan-Crane "M" Type Purifier (Right)

"Continuous" type purifier removes solid contamination as well as products of oxidation (acids, asphaltenes, gums and resins). Keeps neut. number and steam emulsion number within desired limits. Sizes to fit all needs.

CLEAN OIL ENGINEERING

HONAN-CRANE CORPORATION

1200 SIXTH ST., LEBANON, INDIANA

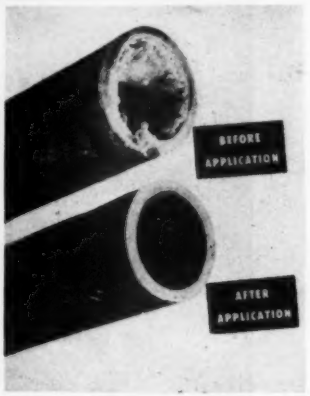
a subsidiary of

HOUDAILLE-HERSHEY CORPORATION

floor area. Device will furnish about 8 hr emergency light from a 7½-v standard dry battery. Built-in meter is for momentary testing of battery.

Electric Cord Co, 30 Church St, New York 7, N. Y.

For more data on these items, use post cards, p 188a. Identify request with P and number.



WATER TREATMENT **P231**

Custom-made boiler-water treatment employs a coagulant combining all advantages of chemical and colloidal methods in a simple, effective system, according to its manufacturer. *Luminite* is designed for effective removal and prevention of scale formation and elimination of pitting, corrosion, rust.

Warren Refining & Chemical Co. 759 Prospect Ave, Cleveland, Ohio.

TRANSFORMER WELDER **P234**

Small, compact, 12x17x23-in. high, 200-amp, Model MCX transformer welder covers a wide range of applications from light-duty sheet-metal jobs to heavy-duty industrial work. Three current ranges can be selected with insulated tapered plug connectors. Infinite hand-crank adjustment within each range provides current from 30 to 250 amp. This permits using 1/16 to 3/16 dia electrodes.

Air Reduction Co, 60 East 42nd St, New York 17, N. Y.

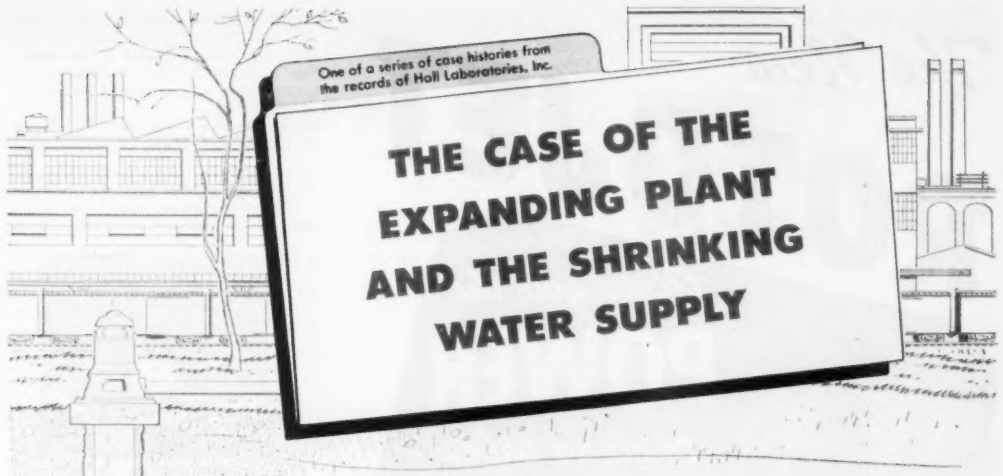
PLASTIC DRILL **P225**

Rotary, polystyrene, 2-ft-long plastic drill, injection molded for a window-type air conditioner, has 18 small louvres for directional delivery of air. Drill will be a part of ¾-hp model air conditioner supplied by York Corp.

General Electric Co, Pittsfield, Mass.

BOILER COVERING **P236**

New canvas covering for boilers and other industrial furnaces, called *Texad*, is said to replace steel plate, improve air tightness, reduce enclosure cost, provide a completely weatherproof finish. *Texad* combines a plasticized synthetic resin emulsion as an adhesive with strips of lightweight canvas, covering seals, shrinkage cracks in finish coats of insulating



One of a series of case histories from the records of Hall Laboratories, Inc.

THE CASE OF THE EXPANDING PLANT AND THE SHRINKING WATER SUPPLY

This midwestern manufacturing plant was ready to expand—but water supply was running so low that failure to meet even existing requirements seemed imminent. The obvious answer seemed to be more wells, so an option was taken on land for a new well field.

Top management, however, was not satisfied with the 'obvious' answer, so, before making the additional investment, they called in Hall Laboratories.

Hall engineers first studied water usage. By solving a stubborn slime problem which had made it necessary to flush condensers with fresh water every day, they saved 60,000 gallons per day. Better synchronization of supply and demand eliminated overflow from storage tanks, and use of waste water instead of fresh wherever possible resulted in further savings. These and other measures which are gradually being put into effect are *reducing water consumption* 50%—bringing current requirements safely within the supply which had been available.

This still left the problem of providing for the proposed plant expansion, so Hall engineers next went to work on the wells. Acidizing had been used previously, with small success, but Hall engineers used a new and inexpensive well cleaning method which cleans out clays and other particles not removed by acid. With this method they *doubled* well capacity, increasing the average from 400 gpm to 800 gpm. At the same time, drawdown was greatly *reduced*.

Result: No investment for new wells; ample capacity for all present needs; and plenty of reserve capacity for the planned expansion.

For more information about Hall Plant-Wide Water Service, and particularly in regard to this new and effective method of restoring the capacity of wells, just fill in and mail the coupon.

HALL LABORATORIES, INC.

(A SUBSIDIARY OF HAGAN CORPORATION)

CONSULTANTS ON BOILER WATER CONDITIONING;
PROCUREMENT, TREATMENT, USAGE AND DISPOSAL OF INDUSTRIAL WATER

Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pa.
Please send me your bulletin:
☐Your Most Important Raw Material ☐Let's Consider Your *Whole* Water Problem

Name_____
Position_____
Company_____
Street & Number_____
City_____ Zone_____ State_____

P-2

The New

ROTOJET®

Gives you the

POWER

to clean tubes

FASTER

You won't believe any tube cleaner can pack such tremendous power, until you try the new ROTOJET. It removes scale so much faster that it usually pays for itself in one cleaning. Models available for practically any size straight and curved tubes. Send for ROTOJET Bulletin.

THE SECRET

ROTOJET Motor has only two moving parts, a shaft and a paddle. Positive contact between paddle and Rotocentric (egg-shape) bore cylinder prevents stalling at low speeds. No leakage. Delivers maximum power for air used.

S-530 ROTOJET Air-driven Motor with swing-frame head for 3¼–3-13/16" I.D. straight tubes.

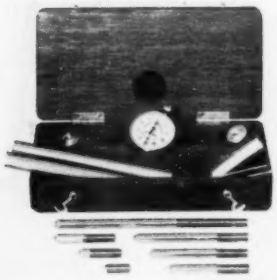
ELLIOTT COMPANY-ROTO DIVISION

153 Sussex Avenue Newark 1, N. J.

cement. It also acts as a safeguard against air leakage caused by insulation porosity. One boiler company is said to have offered this enclosure for two 850,000-lb-per-hr central-station units scheduled for outdoor installation.

Bigelow-Liptak Corp, 2842 W Grand Blvd, Detroit 2, Mich.

For more data on these items, use post cards, p 188a. Identify request with P and number.



ALIGNMENT INDICATOR P251

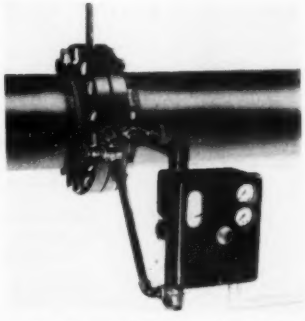
Crankshaft alignment indicator is suitable for all types of gasoline, diesel and dual-fuel engines. Dial type, it is graduated in 1/1000ths, plus or minus 25. Three extension rods and 7 distance pieces handle range from 2¼ to 18 in. between crankshaft webs. Indicator is also suitable for checking connecting-rod bearing clearances, cylinder-liner wear, beam deflections and other jobs.

Beekman Industries Inc, 420 Lexington Ave, New York 17, N. Y.

CHEMICAL FEEDER P226

Highly accurate over a feeding range of 100 to 1 with positive nonflooding feeding mechanism in stainless steel, Model 50-8 midget belt gravometric feeder supplies dry chemicals for industry use continuously by weight over an 8-in. belt with a 1-ft weight span and a capacity of 3 cfm.

Omega Machine Co, 345 Harris Ave, Providence, R. I.



FLOW INDICATOR P216

Combining the advantages of the area meter and the orifice meter, company's new *V A cell* is a precision-flow transmitter developed for differential pressure applications. It measures a by-pass portion

FOR COMPLETE CONDENSER VACUUM CONTROL

POWER MEN LOOK TO KINNEY VACUUM PUMPS

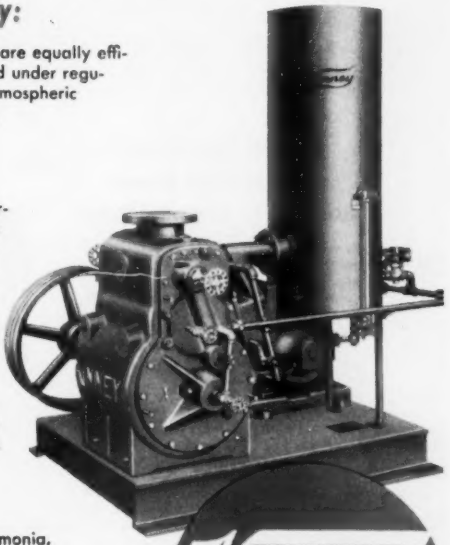
Ease, Economy of Installation:

Kinney Rotary Vacuum Pumps eliminate costly high-pressure pipelines to auxiliary equipment . . . permit the ideal piping layout: a single steam line from boiler to turbine.

Pumping Efficiency:

Kinney Rotary Vacuum Pumps are equally efficient when starting the boiler and under regular running conditions — from atmospheric down to a fraction of an inch Hg. abs.

Plant Operation:



A Kinney-equipped power plant is easier to operate. There are no troublesome reducing valves and "hogging jets" which require constant attention. The Kinney Rotary Vacuum Pump is controlled from the central control panel.

Day-after-day Dependability:

Kinney Rotary Vacuum Pumps have an oil-sealed, non-wearing pumping mechanism. There's no scrubbing action within the pump — nothing to detract from long life and high-level performance.

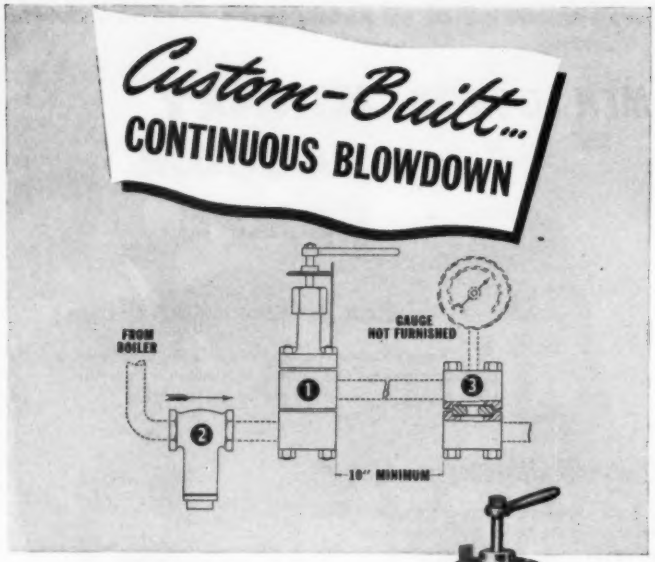
Contaminant Removal:

Kinney Pumps remove carbon dioxide, ammonia, and other corrosive gases while controlling the condenser vacuum. There's no tendency to concentrate these contaminants as with steam-jet ejectors.

More and more major power plants are obtaining the proven advantages of Kinney Mechanical Vacuum Pumps for condenser vacuum control. If your plans call for high pressure — high temperature throttle conditions, Kinney Engineers will be glad to show you facts and figures on Kinney Pumps. Kinney Manufacturing Company, 3532 Washington St., Boston 30, Mass. Representatives in New York, Chicago, Cleveland, Houston, New Orleans, Philadelphia, Los Angeles, San Francisco, Seattle, and foreign countries.

Kinney VACUUM PUMPS

Send for "Use of Mechanical Vacuum Pumps in Central Station Operation" — an engineering report including installation drawings. Also Kinney Vacuum Pump Bulletin V45.



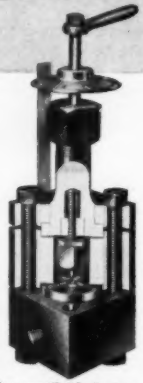
STRONG Dual-Orifice Assembly gives Greater Accuracy . . . Rugged Service!

Strong's Continuous Boiler Blowdown Assembly includes a Strong *block steel* Evrtyte* Valve (1), a strainer (2) and an orifice block (3), *custom-built* and accurately sized for *your own job conditions.*

The assembly is essentially two orifices arranged in series. The first orifice (valve) is variable . . . . the second is fixed. Correct proportioning of orifices provides extremely accurate control and reduces wire drawing.

Strong Evrtyte steel valves have special Anum-Metl X seats and discs of 750 Brinell surface hardness for long life. Available for pressures to 1500 psi and temperatures to 800° F. or 6000 psi non-shock cold service.

Let us custom-size your continuous blowdown system. Send for Catalog No. 68-P and our Continuous Blowdown Check-Chart today!



Also available in outside screw and yoke.

*Reg. Trade Mark

STRONG, CARLISLE & HAMMOND COMPANY

1392 WEST 3rd Street
Cleveland 13, Ohio

† ANUM-METL Reg. Trade Mark

OTHER STRONG STEAM SPECIALTIES

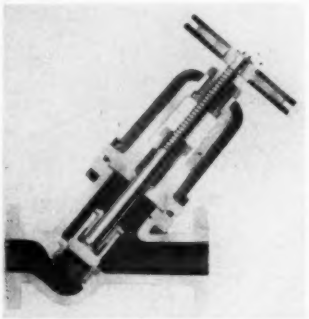
Reducing Valve | 80 Series Trap | Strainer

STRONG

of the main line and is basically a through-flow instrument. Continuous self-purging is thus provided. It features high accuracy with wide-range linear scale. The *V A* is mercury-less, but does not use any diaphragm. Manifold system, bellows, seals, exterior purges, condensate chambers are all eliminated. The cell is applicable to service on liquids, gas and vapor streams, including steam.

Fischer & Porter Co, 42 County Line Road, Hatboro, Pa.

For more data on these items, use post cards, p 188a. Identify request with P and number.



BOILER BLOWOFF VALVES P247

Straightway Y-type boiler blowoff valve is available in 1½, 2 and 2½ in. sizes in cast iron or cast steel for pressures up to and including 600 psi. Head or disk is made of H monel and seat is monel. Renewable seat has upper and lower sealing gaskets to protect seat threads from corrosion. Stem is stainless steel and stem nut is bronze. All parts renewable without use of special tools.

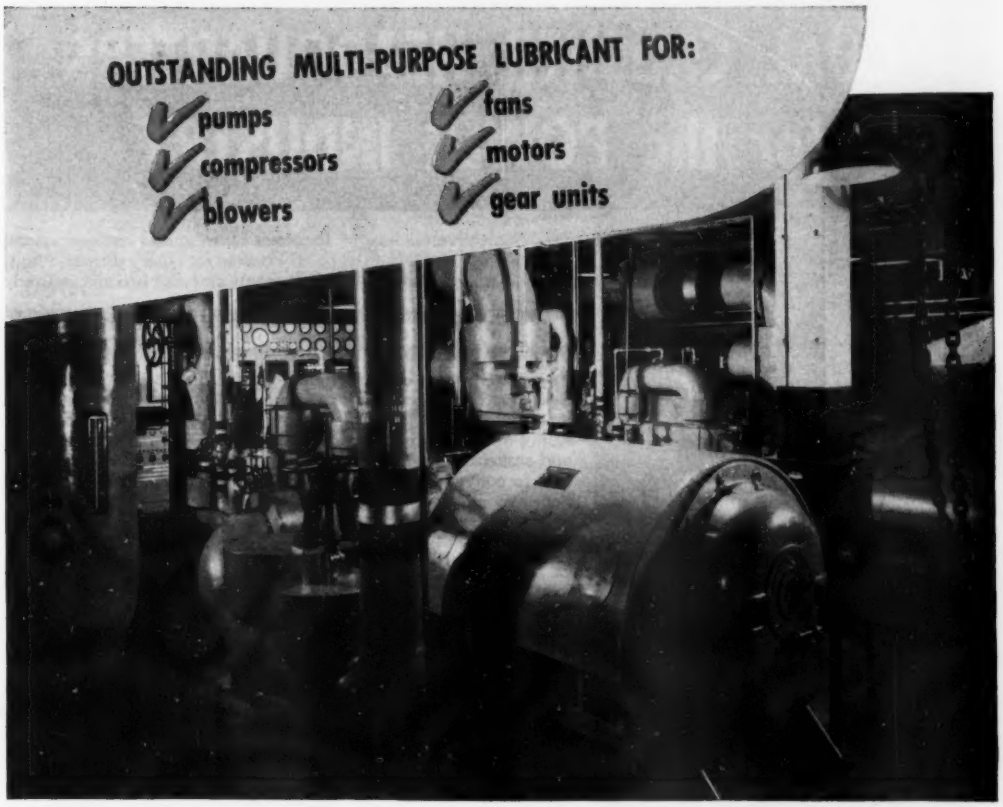
Everlasting Valve Co, Dept 42, 49 Fisk St, Jersey City, N. J.

SILICONE-TREATED TISSUE FOR GOGGLES P280

Magic Lens Tissue were developed for cleaning goggles and glasses in plants and offices. Sheets are interfolded so they can be handled in a simple dispenser.

The Silicone Paper Co of America Inc, 230 Park Ave, New York 17, N.Y.

Cut maintenance costs with Gulf Harmony Oil_



Gulf Harmony Oil is a top quality multi-purpose lubricating oil, ideal for sleeve-type bearings, oil-lubricated ball and roller bearings, hydraulic systems, compressor cylinders, and many types of gears.

Because of outstanding oxidation stability, Gulf Harmony Oil has exceptional resistance to sludging. In force-feed circulating systems, oil reservoirs, hydraulic lines, and antifriction bearings, the use of Gulf Harmony Oil helps prevent harmful deposits, insures fewer oil changes.

Gulf Harmony Oil provides a protective film which has preferential wetting characteristics for metal—displaces moisture, interrupts its corrosive action. Thus Gulf Harmony Oil eliminates rust on all oil-bathed surfaces—particularly important in antifriction bearings operating under damp conditions. And it separates readily from water, reducing the possibility of emulsification.

Its high lubricating value means more effective protection against wear under boundary conditions. Available in a wide range of viscosities.

For complete information on Gulf Harmony Oil and for expert help on any lubrication problem, call in a Gulf Lubrication Engineer today. Gulf Oil Corporation · Gulf Refining Company, Gulf Building, Pittsburgh 30, Pennsylvania.

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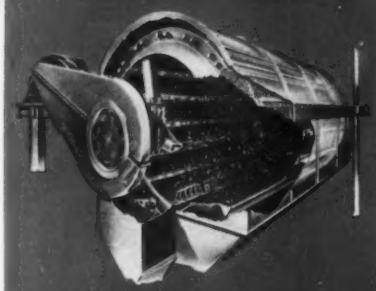
PENNSYLVANIA

COAL CRUSHER HEADQUARTERS for the POWER INDUSTRY

The Pennsylvania line of Crushers is so varied and complete that there is a size and type of crusher for every Power Plant regardless of size or nature of the coals and size product desired.

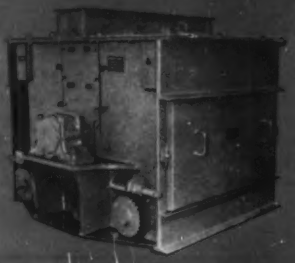


BRADFORD BREAKERS

For nearly half a century Pennsylvania Bradford Breakers and Bradford Hammermills have been used by power plants as the most economical primary crushers and cleaners for preparing run-of-mine coal to a product suitable for feed to pulverizers and stokers. The dependable scavenging feature assures protection to conveyors, stokers and pulverizers from tramp iron and debris. Send for literature.

GRANULATORS—RING TYPE

Pennsylvania Ring Type Granulators serve as primary and secondary crushers for reducing run-of-mine or smaller coal to a product suitable for feed to pulverizers and stokers. Ring Type Granulators have a built-in non magnetic Tramp Iron Trap. The Pennsylvania is far in advance of other ring type crushers due to the crushing action brought about by a patented feature that permits the rings to roll more slowly while crushing the coal uniformly. Granulators are generally selected only where conditions do not permit installation of the more efficient Bradford Breaker. Send for literature.



REVERSIBLE HAMMERMILLS

Pennsylvania Reversible Hammermills are giving excellent service in the preparation of coal to meet the exacting specifications for cyclone burner installations. This crusher is made in a special pressurized type for direct firing — standard type for bin system. The reversible feature makes this crusher two crushers in one. Lowers maintenance costs. Send for literature.

PENNSYLVANIA CRUSHER COMPANY
DIVISION OF BATH IRON WORKS CORPORATION

PENNSYLVANIA CRUSHER COMPANY

Division of Bath Iron Works Corporation, 1714 Liberty Trust Building, Philadelphia 7, Penna. Representatives in New York, Boston, Pittsburgh, Birmingham, Roanoke, Detroit, Chicago, St. Louis, Crosby, Minn., Los Angeles, London, England.

Single Roll Crushers — Reversible Impactors — Reversible Hammermills — Ring-Type Granulators — Bradmills — Bradford Hammermills — Kue-Ken Jaws — Kue-Ken Gyratories — Dixie Non-Clog Hammermills — Dixie Feed Mills

PLANT EQUIPMENT NEWS

Reader Service Page for New Products and Literature

Use the handy FREE service cards for additional information on this month's new products or for copies of latest trade catalogs.

AIR CONDITIONING, HEATING REFRIGERATION AND VENTILATION

A8 **PRESSURE BLOWER** — 32-page booklet No. 5001 covers the new Moore Class 2000 direct-drive axial-flow pressure blower for volumes up to 100,000 cfm and pressure up to 4 in. wg. Engineering data and price list are given. Moore Co, 800 S Missouri, Marceline, Mo.

A9 **COOLING TOWERS** — 4-page folder No. 44 describes the new Binks Type H Series of atmospheric spray cooling towers for small packaged water-cooled air conditioning and refrigeration condensing units and related applications. Selection tables, specifications, dimensions and weights are included. Binks Mfg Co, Water Cooling Div, 3114-40 Carroll Ave, Chicago 12, Ill.

A10 **UNIT HEATER**—Form No. 1950 features a new compact unit heater weighing only 57 lbs yet capable of delivering sufficient heat for locomotive cabs, power plants, small buildings and similar small areas. Capacities and dimensions are included. Young Radiator Co, Racine, Wis.

CONTROLS, MECHANICAL

E14 **ELECTRONIC COMBUSTION CONTROL**—8-page bulletin No. 1100 describes a new electronic master combustion control system and tells how it operates. Contains many photos and diagrams. Republic Flow Meters Co, 2240 Diversey Pkwy, Chicago 47, Ill.

E15 **TEMPERATURE MONITOR** — 16-page publication gives informative data on the Edison critical temperature monitor which provides a dependable means of automatic, frequent, and regular temperature checking at selected locations in mechanisms, spaces, or processes. Thomas A Edison Inc, Instrument Div, West Orange, N. J.

ELECTRICAL EQUIPMENT

F48 **INDUCTION MOTORS**—8-page brochure No. 05B7550 contains construction features of Allis-Chalmers large 2-pole squirrel cage induction motors. A cross-section view of a typical normal torque, low-starting current motor is given. Allis-Chalmers Mfg Co, 962 S 70th St, Milwaukee, Wis.

F49 **DISTRIBUTION TRANSFORMERS** — 4-page folder No. 50-FC features air-cooled distribution transformers, lighting transformers, power center and packaged-power units. Marcus Transformer Co, 32-34 Montgomery St, Hillside 5, N. J.

HEAT EXCHANGER

G7 **FEEDWATER HEATER**—Single-sheet form No. S-201-A presents the new all steel Swartwout junior feedwater heater for preheating feedwater supply in small power plants of 300 hp or less. Specifications and shipping weights are listed. Swartwout Co, 18511 Euclid Ave, Cleveland 12, Ohio.

G8 **OIL COOLER** — Form No. 1250 tells about the specially designed "A-800" shell and tube bundle heat exchangers developed for oil cooling in diesel locomotive, diesel engine, gasoline engine, and similar applications. Young Radiator Co, Racine, Wis.

HOW TO ORDER ADDITIONAL DATA

Be sure to fill out, completely, one coupon for each item of information you order. (See sample, right.) This gives your request authority and helps the manufacturer to address your copy completely.

When you have filled out completely one space for each item of information you want, detach along the scored lines and drop the cards in the mail.

Example

Write here number of item in which you are interested → E17

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G9 **HOT WATER HEATER**—4-page leaflet No. SM-41 gives ratings and specifications for 5 sizes of O'Brien all-bronze "packaged" steam-mixer water heaters for 50 to 125 lbs steam pressure. O'Brien Steam Specialty Co, 393 Hofernan Bldg, Syracuse 2, N. Y.

MAINTENANCE AND SAFETY EQUIPMENT

K21 **MACHINIST VISE**—4-page bulletin No. A-601 contains full information about the new Dodge Slide-Set vise, a powerful, rugged tool that grips like a conventional vise, but eliminates handle spinning. Dodge Mfg Corp, Mishawaka, Ind.

K22 **PHASE INDICATOR** — Data sheet No. 7A explains characteristics and uses of a pocket-size phase sequence indicator. Actual-size photo and price are given. Associated Research Inc, 3770 W Belmont Ave, Chicago 18, Ill.

K23 **METAL INSPECTION** — 4-page folder No. 500 shows how Dy-Check, the dye penetrant method of metal inspection, simplifies non-destructive testing. Dy-Check Co, 1515 E Broadway, Hawthorne, Calif.

MAINTENANCE MATERIALS

L37 **PROTECTIVE COATING**—Leaflet, entitled "Protecting and Preserving Old and New Masonry with Longlife," tells about a heavy paste designed for protecting and preserving masonry. Flexrock Co, 3677 Filbert St, Philadelphia 4, Pa.

L38 **PACKING AND GASKETS** — 8-page bulletin describes Garlock packings and gaskets made of Teflon, for use against all acids, all alkali solutions and all organic solvents. Typical applications are discussed. Garlock Packing Co, Palmyra, N. Y.

L39 **SPRING COSTS**—8-page booklet "Spring Buyer's Guide," is designed to aid economical purchasing by reducing to understandable terms the various factors affecting the cost of coil springs. Hunter Spring Co, Landsdale, Pa.

L40 **INDUSTRIAL HOSE** — Catalog No. H-1451-A is a revised and more complete edition on reusable steel hose ends, industrial hose and hose couplings. Weatherhead Co, Industrial Sales Div, 300 E 131st St, Cleveland 8, Ohio.

L41 **STORAGE BINS** — 12-page folder features storage bins for handling flowable bulk materials. Data tables show capacities in bushels, cubic feet, and tons in relation to heights and diameters. Neff & Fry Co, 270 Elm St, Camden, Ohio.

L42 **CORROSION-RESISTING RESIN**—Data sheet No. C-42 describes Carbo-Kote 6020, a room temperature thermosetting corrosion-resisting resin, applied by brush, for lining tanks and covering floors and equipment subjected to corrosive service. Carboline Co, 7603 Forsyth Blvd, St. Louis 5, Mo.

L43 **PISTON RINGS** — One 12-page and two 8-page catalogs are offered. Piston rings, metallic rod packing and Bakelite products (including piston rings and rod packing) are illustrated and described in these pamphlets. Double Seal Ring Co, Box 550, Fort Worth, Texas.

MATERIALS HANDLING

M20 **CAR SHAKER**—8-page bulletin No. O7B7221A presents the Allis-Chalmers car shaker for unloading granular material from hopper-bottom gondola cars. Construction features, specifications and a cross-section view through the vibrating mechanism are given. Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.

M21 **CONVEYOR AND ELEVATOR BELTING**—16-page booklet No. 3679 covers all types of conveyor and elevator belting. Contains a discussion of each of the various types and suggestions for their application. Thermoid Co, Trention, N. J.

M22 **CHEMICAL FEEDER**—8-page folder No. 35-G5 features the firm's new midget belt Gravimetric chemical feeder, a small weighing feeder for dry materials. Illustrations include various component parts, dimension drawings, and typical installations. Omega Machine Co, 345 Harris Ave, Providence, R. I.

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MECHANICAL TRANSMISSION

N22 **BELTS AND PULLEYS** — 40-page book, entitled "Uni-Pull Drive Manual," enables the reader to select, without calculation, proper size of flat leather belt and pulleys of the correct dimension to transmit power from a motor of a given hp and speed to a machine to be operated at a prescribed speed. American Leather Belting Assn, 41 Park Row, New York 7, N. Y.

N23 **VARIABLE SPEED DRIVE**—4-page bulletin No. AS-1600-B3 gives informative data on Worthington's Allspeed drive, a variable speed transmission of simple, sturdy and compact design, that provides correct production speeds for any given job that requires speed changes quickly and smoothly. Worthington Pump & Machy Corp, Allspeed Drive Div, Holyoke, Mass.

N24 **FLUID POWER**—8-page publication No. 10051-A illustrates and describes complete line of fluid power pumps, motors, transmissions, cylinders and valves used extensively in the iron, steel, metal working, rubber, textile, etc, industries. Oilgear Co, 1560 W Pierce St, Milwaukee 4, Wis.

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METALS AND ALLOYS

R7 **HIGH-TEMPERATURE ALLOYS** —96-page book, entitled "Haynes Alloys for High-Temperature Service," contains technical data on 10 alloys specially developed to meet exacting demands of service at elevated operating temperatures. A section on each alloy gives general description, recommended uses, chemical composition, and physical and mechanical properties, in both tabular and graphic form. Haynes Stellite Div, Union Carbide & Carbon Corp, Kokomo, Ind.

R8 **STEEL TUBING**—20-page booklet No. TB-335 presents brief descriptions of terminology used in the manufacture and application of steel tubing. Babcock & Wilcox Tube Co, Beaver Falls, Pa.

R9 **STANDARD STEELS** — 4-page technical data card No. 119C is a revised edition of combined standard steel lists of AISI and SAE. Covers 3

(*Continued on page* 190)

HOW SUPERIOR'S 4-pass design gives you . . .

Taper Tube EFFICIENCY

The long-lived efficiency of Superior Steam Generators results from fundamentals of design which are basically sound. Superior's 4-pass, down-draft design provides a minimum of 5 sq. ft. of heating surface for each unit of horsepower rating; **and every inch of that heating surface is effective.**

WHY 4-PASS?

Theoretically (from the standpoint of heat transfer alone) the fire passes of a perfectly designed fire tube boiler would resemble a long, very gradually tapered cone surrounded by water. The large end would be sized in ratio to the volume and speed of the combustion gases so that the gases would be crowded into the tube and thus "scrub" the walls of the tube, forcing contact between fire and tube surface. As the gases give up their heat to the surrounding water (by transfer through the tube) the gases shrink in volume. The gradual taper of the tube compensates for this shrinkage, maintaining the scrubbing action which promotes efficient heat transfer.

Such a fire tube is impractical; but Superior's 4-pass design achieves the same effect. Its 4 passes are so designed that each successive pass has a lesser number of tubes (and hence a smaller area in cross section) for the passage of combustion gases. This is, in effect, **taper-tube** performance which results in the maximum practical efficiency of heat transfer . . . performance which makes it possible for Superior to guarantee **more** than 80% thermal efficiency **under field operating conditions.**

Superior Steam Generators are completely factory assembled, backed by undivided responsibility. Burn gas or oil, or both. Manufactured in 18 sizes from 20 to 600 b.h.p. for pressures up 250 p.s.i. or for hot water.

Write today for the details in Catalog 301.

Superior Combustion Industries, inc.

Factory, Emmaus, Pa.
Executive Offices, Times Tower, Times Square, New York 18, N. Y.

TAKE A DART APART!
you'll see at once why DARTS are your best buy!
To get top resistance to stress and stretching, we've made body and nut of high-test, air-refined malleable iron.
Special oscillating grinders give these non-corroding bronze seats a true bearing surface.
Extra width of seats ensures a drop-tight joint without excessive wrenching.
No danger of deforming or stripping with full, clean-cut threads like these.
It's an extra heavy nut so it'll easily shrug off careless wrenching.
No wonder you can use Darts again and again — always count on them for extra service at lower costs.
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groups: basic open-hearth and acid-bessemer carbon steels and resulfurized carbon steels; open-hearth and electric-furnace alloys steels; and stainless and heat-resisting steels, subject to standard variations for check analysis. Babcock & Wilcox Tube Co, Beaver Falls, Pa.

METERS AND INSTRUMENTS, MECHANICAL

T22 **TEMPERATURE INDICATOR** —12-page bulletin No. 404 introduces the firm's new line of thermocouple actuated Microsen temperature indicators and recorders, capable of measuring temperature between minus 100 F and plus 3000 F. Design features and specifications are listed. Manning, Maxwell & Moore Inc, 11 Elias St, Bridgeport 2, Conn.

T23 **ELECTRONIC FLOWMETER** 4-page folder No. 1050 tells about the Potter electronic flowmeter which eliminates bearing maintenance, friction drag, and high pressure drop. Sizes and applications are given. Potter Aeronautical Co, 87 Academy St, Newark 2, N. J.

PIPING, FITTINGS, VALVES AND SPECIALTIES

U44 **AUTOMATIC VALVES**—8-page booklet No. 299 covers Cash-Acme's entire line of automatic valves for pressure relief and pressure reducing. Each type is illustrated and described, including hot water heat controls. Dimensions and ordering data are given. A W Cash Valve Mfg Corp, 666 E Wabash Ave, Decatur 60, Ill.

U45 **FLOAT TRAPS** — 4-page brochure No. 950 gives complete specifications, capacities, pressures, sizes, and price lists of 3 principle Anderson float traps, widely used to drain condensate from steam equipment as well as moisture from air and gas equipment. V D Anderson Co, 1934 W 96th St, Cleveland 2, Ohio.

U46 **VALVES AND ACCESSORIES**—16-page catalog No. 100 contains detailed information on packless and packed valves, relief and check valves, strainers, driers, and liquid level gages for refrigeration, air conditioning, and industrial applications. Henry Valve Co, 3215 North Ave, Melrose Park, Ill.

PUMPS

W22 **CENTRIFUGAL PUMPS** — 16-page booklet No. 7233 discusses the Ingersoll-Rand Class HMTA and HMTB multi-stage, horizontally-split, centrifugal pumps for pressures up to 1200 psi. Design details and advantages are furnished. Ingersoll-Rand Co, 11 Broadway, New York 4, N. Y.

W23 **CLOSE-COUPLED PUMP** — 6-page folder No. 52B6140B features Allis-Chalmers Electrifugal close-coupled pump mounted in an exclusive unit-cast frame which has no adapter or joints between motor and pump. Three available styles are shown. Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.

W24 **CONTROLLED VOLUME PUMP** —Single-sheet bulletin No. MP-50 presents a new Milton Roy controlled volume pump for handling minute quantities of clear liquids. Applications include laboratory and research work, pilot plant and semi-plant scale operations, etc. Milton Roy Co, 1300 E Mermaid Lane, Philadelphia 18, Pa.

WELDING

Y7 **ENGINE-DRIVEN WELDER** — Form No. 1304-7500 contains specifications and applications of Lincoln "Shield-Arc SAE" engine-driven welder. Lincoln Electric Co, 12818 Coit Rd, Cleveland 1, Ohio.

Y8 **ALLOYS AND FLUXES**—32-page pamphlet is a buyer's guide to the complete line of All-State alloys and fluxes for welding, brazing, soldering, cutting, and tinning. All-State

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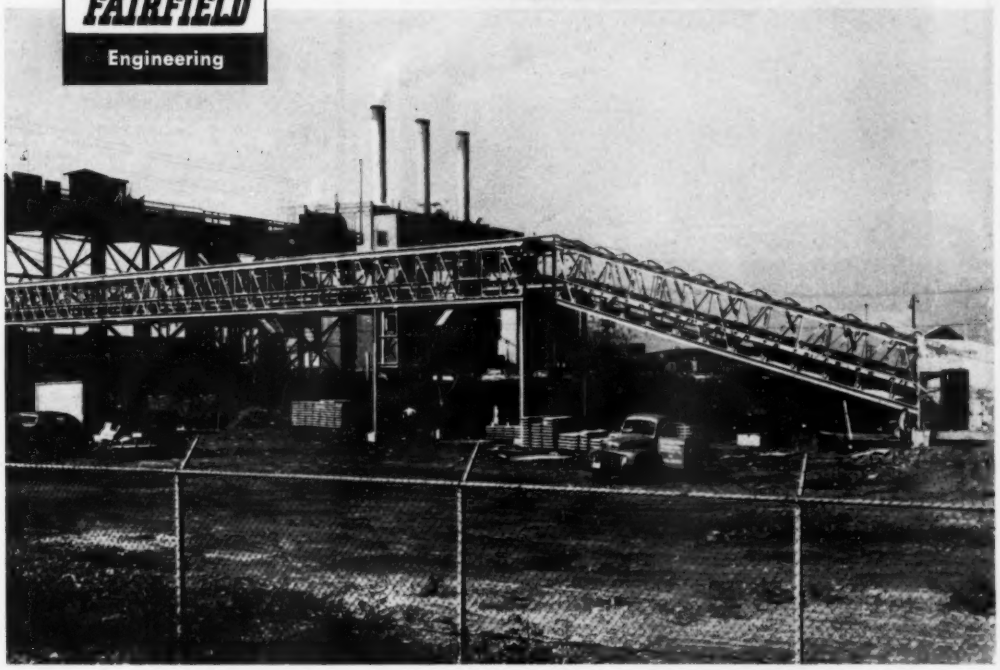

A Case of "KNOW-HOW"...

When a municipal light plant of a large Midwestern city found it necessary to extend their facilities, Fairfield engineers constructed a system which added new and enlarged ground storage facilities in the manner illustrated above. Coal received by railroad car is delivered to initial pile by 30"x205' ground storage belt conveyor . . . coal from reclaim hopper is taken by 30"x340' reclaim belt conveyor to original system. The system was designed to handle coal from ground storage across a street, some distance from the plant.

The ground storage conveyor and the reclaiming conveyor shown above are housed in a single conveyor gallery.

When planning to build or to remodel your plant, the Fairfield "know-how" developed through 30 years of planning, engineering and construction experience will assure you of a highly efficient, economical coal and ash handling system. Call in a Fairfield engineer today—he will design a system tailored for your particular plant requirements. Full particulars of proven Fairfield layouts are available in Bulletin 650. Write for your copy today.

THE FAIRFIELD
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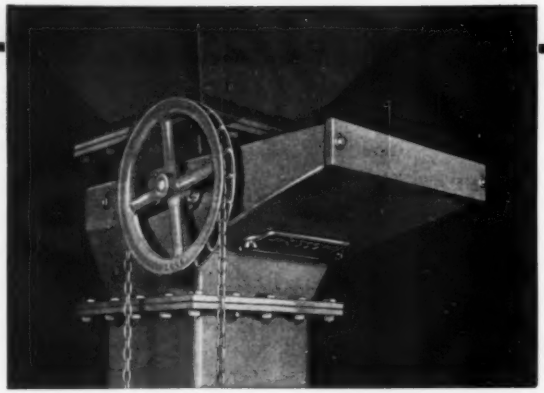
335 CHICAGO AVE., MARION, OHIO



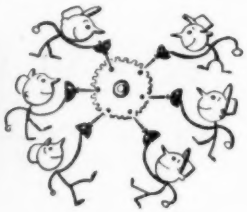
S-E-CO. COAL VALVES always operate easily because they are equipped with double racks and pinions. This design moves the gate squarely and without binding. S-E-Co. Coal Valves fit the requirements of today's modern plants.

Send request for bulletin to

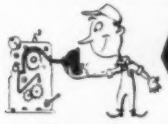
STOCK EQUIPMENT COMPANY
715P Hanna Building ★ Cleveland 15, Ohio

Manzel AUTOMATIC FORCE FEED LUBRICATION

Gives each wearing point a full-time 'oiler'



Frees manpower for more productive jobs.



Reaches vital parts ordinary methods can't lubricate.

Meters the precise amount of oil needed.

Manufacturers using Manzel Lubricators report that they save their initial cost many times over in reduced labor cost, lower oil consumption, and fewer breakdowns. "Manzels" are standard equipment on many makes of engines, pumps, compressors, hydraulic presses, conveyors, and other machinery. Or...you can install them on present equipment.

Manzel representatives will gladly supply technical assistance on lubrication problems.

Manzel

Division of
FRONTIER INDUSTRIES INC.
326 BABCOCK ST.
BUFFALO, N. Y.

Welding Alloys Co, 273 Ferris Ave, White Plains, N. Y.

Y9 **BRONZE ELECTRODES**—24-page reference book No. W-17 consists of technical and pertinent information about every bronze electrode which the firm manufactures along with recommended welding techniques, procedures, and machining suggestions. Ampco Metal Inc, 1745 S 38th St, Milwaukee 46, Wis.

OTHER EQUIPMENT

Z40 **DUST COLLECTOR** — 4-page bulletin describes the company's Aerodynamic dust collector which can be used in practically any situation where dust laden air or gases have to be cleaned either for the recovery of useful or valuable substances, or for elimination of dusts from flue gases and industrial processes. Aerodyne Development Corp, 879 Addison Rd, Cleveland, Ohio.

Z41 **ACOUSTICAL TILE** — 8-page publication, entitled "Fiberglas Textured and Perforated Acoustical Tile," includes data on textured and perforated acoustical products, application methods by adhesive, mechanical suspension or clipping on wood furring strips, and specifications. Owens-Corning Fiberglas Corp, Toledo 1, Ohio.

Z42 **X-RAY PHOTOMETER**—8-page bulletin No. GEC-412A explains the theory of operation, principal components, and operating procedure of the G-E x-ray photometer for chemical analysis by x-ray absorption. Some of the applications in the petroleum and chemical industries are listed. General Electric Co, Schenectady 5. N. Y.

Z43 **DIESEL ENGINES** — 4-page folder No. 320 covers the Baldwin Series 700 diesel engines which are 4-cycle with 17-in. bore, 20-in. stroke. Speed ranges from 257 to 375 rpm. Design features, specifications, cross-sectional drawings, performance curves, and ratings are included. Baldwin-Lima-Hamilton Corp, Philadelphia 42, Pa.

Z44 **CHLORINIZER** — 4-page brochure No. 840-G27 discusses the Builders Model HCVS high capacity, visible flow chlorinizer designed to meter chlorine gas accurately and to deliver a chlorine-water solution to the point of application. Builders-Providence Inc, 335 Harris Ave, Providence, R. I.

Z45 **ISOMETRICS** — 8-page booklet outlines advantages of isometric drawings (including exploded drawings) in the manufacturing industries. Book offers isometric engineering service, including consultation, visuals and manuals. Isometric Co, 1819 Broadway, New York 23, N. Y.

Z46 **NEW AND REBUILT EQUIPMENT**—48-page stock list No. 102 gives brief specifications for new and rebuilt ac and dc motors, generators, generator sets, frequency changers, transformers, welders, speed reducers, centrifugal pumps, and miscellaneous equipment currently in stock. Glow Electric Co, 933 Harriet St, Cincinnati 3, Ohio.

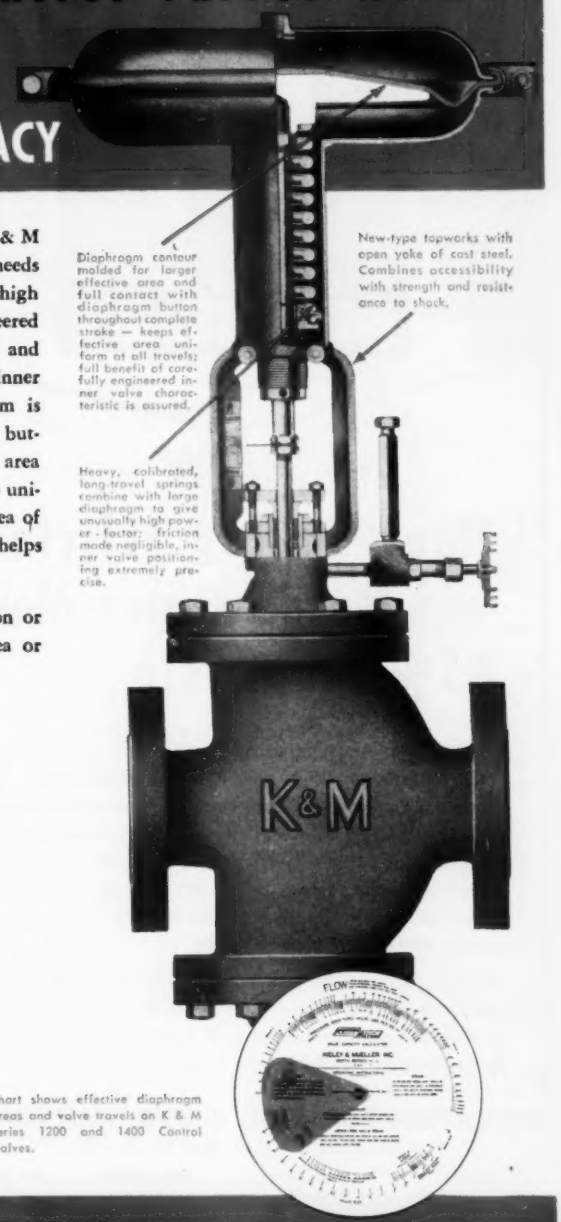
Z47 **REFERENCE BOOKS**—Catalog furnishes over 2000 listings of Lefax pocket-size technical books. Subjects listed include: hydraulics, machine design, piping data, metallurgy, transformers, relays, meters, ac-dc electricity ac motors and generators, air conditioning, physics, and many others. Lefax, Philadelphia 7, Pa.

Boeing Aircraft Co of Seattle, Wash., is cooperating with the engineering experiment station of Oregon State College in a research program aimed at developing a gas turbine to generate power for operating sawmills and other plants isolated from electrical and water power but with readily available supplies of wood, Gas to operate the turbine would be generated by burning wood under pressure in a specially designed furnace.

K&M The Control Valves with GREATER POWER for GREATER ACCURACY

The Diaphragm Motor of the far-advanced K & M Control Valve is designed for the more exacting needs of modern process industries. An unusually high power-factor is obtained by the carefully-engineered relationship of large effective diaphragm area and heavy, calibrated spring; friction is negligible, inner valve positioning more precise. The diaphragm is specially designed for constant affinity with the button contour; this assures a uniform effective area throughout the complete valve stroke, thus more uniformly accurate control. The unusually large area of the diaphragm in relation to the valve size also helps assure more precise control.

K & M motors are available for direct action or reverse action without change in effective area or stroke.


Diaphragm contour molded for larger effective area and full contact with diaphragm button throughout complete stroke — keeps effective area uniform at all travels; full benefit of carefully engineered inner valve characteristic is assured.
New-type topworks with open yoke of cast steel. Combines accessibility with strength and resistance to shock.
Heavy, calibrated, long-travel springs combine with large diaphragm to give unusually high power-factor; friction made negligible, inner valve positioning extremely precise.
K&M

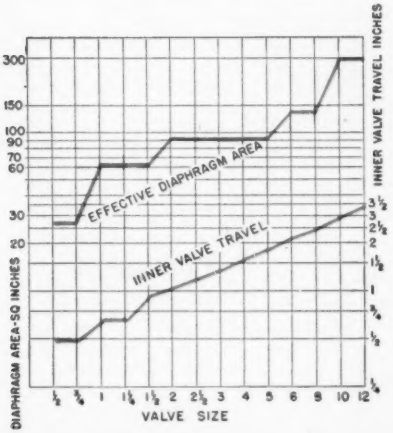


Chart shows effective diaphragm areas and valve travels on K & M Series 1200 and 1400 Control Valves.

KIELEY & MUELLER

Established 1879

2301—42nd Street North Bergen, N. J.

This extremely accurate circular slide-rule type K & M valve capacity calculator includes corrections scales for steam quality, liquid and gas specific gravity and a flowing temperature scale for gases. Sent without charge in response to a request on your business stationery.

MUNDET

NEW

Heat Saving Efficiency with Mundet Custom Molded 85% Magnesia

Now available in pipe covering and block insulation, Mundet 85% Magnesia permits new heat-saving efficiency. Precision manufacturing on the latest type of automatic equipment insures uniform standards. Extra durability is built into the insulation. It does not "powder," settle or disintegrate. It is unaffected by either steam or water leakage. It maintains an attractive, smooth finish. Precision pipe fit is assured, with no spaces left for the escape of heat.

You benefit from the most modern manufacturing facilities for the production of heat insulation. Write for specification information and recommendations. Mundet Cork Corporation, Insulation Division, 7107 Tonnelle Avenue, North Bergen, N. J.

INSULATION FOR HIGH & LOW TEMPERATURE

Mundet district offices are located in these cities:

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CHICAGO 16
2601 Cottage Grove Ave.

CINCINNATI 2
427 West 4th St.

DALLAS 1
601 Second Ave.

DETROIT 21
14401 Prairie St.

HOUSTON 1
Commerce and Palmer Sts.

INDIANAPOLIS
15 E. Washington St.

JACKSONVILLE 6, FLA.
800 E. Bay St.

KANSAS CITY 7, MO.
1428 St. Louis Ave.

LOS ANGELES
(Maywood): 6116 Walker Ave.

NEW ORLEANS 16
315-25 N. Front St.

NEW YORK 17
331 Madison Ave.

PHILADELPHIA 39
856 N. 48th St.

ST. LOUIS 9
3176 Brannon Ave.

SAN FRANCISCO 7
440 Brannon St.

In Canada: Mundet Cork & Insulation, Ltd. 35 Booth Ave., Toronto

QUICK TEST

(*Continued from page 87*)

solids content of the water tested.

The ion-exchange material used in this test must have a very high and rapid exchange capacity and be of uniform quality. It must be processed very carefully to obtain complete hydrogen regeneration, and washed entirely acid free. Nalcite HCR, reagent grade, processed by Nalco Ion Exchange Laboratory, was the material used in these tests. It is a high-capacity cation-exchange resin of the styrene-base type, produced in spherical form of controlled particle size to provide optimum exchange characteristics. It is physically and chemically stable at temperatures up to boiling and through the entire pH range.

The quantity of resin (0.5 cu in.) used in this test is enough for dissolved solids readings as high as 300 gpg (5100 ppm). Numerous tests were made to verify this figure and determine the necessary contact time between sample and resin. Thirty seconds of thorough mixing was sufficient to reach the desired equilibrium condition in all cases. Increasing contact time to periods as long as one hour had no appreciable effect on results obtained.

The indicator used in the Nalco laboratories was the special indicator No. 260 available with the test kit, photo, p 87. A 0.1% aqueous solution of alizarin red S was also found satisfactory.

At present this method is not recommended for raw waters or other waters of extremely low concentration (below 20 gpg). Further work will be done to adapt the method to these conditions.

Still another precaution needs to be kept in mind. Samples with extremely high ratios of chloride to sulfate content may require an adjustment of the multiplication factor, see Discussion, p 87, to correct for this condition.

POWER NEWS

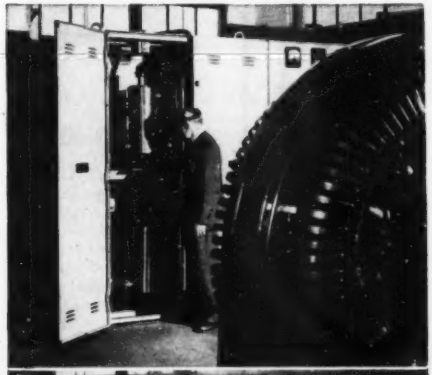
(*Continued from page 134*)

experimental run it took 210 cfm at a starting pressure of 15 psi. By the end of the first day it dropped to 2 psi. Estimates placed the coal gasified by such an air stream as running about 3500 lb per 24 hr. When air is first added several hours are required for temperature to build up and give a good quality gas, said to be a producer gas of 120 to 150 Btu per cu ft.

Yield and richness of total gas obtained depends on proportion of coal gas produced by electrical carbonization and of producer gas made by gasification with air.

$30,000 back in 5 years

The 500-kw, 250-volt G-E rectifier at the Florence Pipe Foundry and Machine Company requires only periodic inspection.



The G-E rectifier provides the d-c power which operates the cranes, ladles, and centrifugal casting machinery in the Florence Company's plant.

Florence Pipe Foundry & Machine Company

GETS LOW-COST D-C POWER WITH G-E RECTIFIERS

When the Florence Pipe Foundry & Machine Company needed additional d-c power in 1946, George E. Pfeffer, electrical engineer, looked for the best way to do the job. He learned that installing G-E rectifiers would save in three ways:

1. Installation costs—$10,000 less

The rectifiers were compact enough to fit into the present power house. Other types of generating equipment required the construction of a costly new building.

2. Operating costs—no new personnel needed

Because rectifiers need only periodic inspection, there's no need for standby personnel.

3. Power costs—$600 a year less

The extra high efficiency of G-E sealed rectifiers saves about $600 a year in power bills.

The combined savings will amount to $30,000 in five years. That will pay for the rectifiers, and for the cost of installing them.

To Cut your Power Costs

Find out today how you can put G-E power rectifiers to work in your plant. Call or write your nearest G-E sales office for information. **Apparatus Department, General Electric Company, Schenectady, N. Y.**

324-2

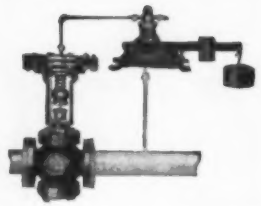
G-E MERCURY-ARC RECTIFIERS MEAN LOW-COST D-C POWER

GENERAL ELECTRIC

ATLAS

Super-Sensitive

PRESSURE REGULATORS



You will like these remarkable regulators. They are particularly adapted to service where pressures must be maintained within fractions of one pound and without perceptible variation even where demands fluctuate and widely varying initial pressures occur. They are suitable for steam, air or gas where it is essential to maintain a constant reduced pressure in heating mains, vats, cookers, retorts, etc. They are also used as altitude regulators to maintain constant level in open tanks, or as a pump governor to assure constant pump discharge pressure. The scope of application of this ATLAS Regulator is almost unlimited in pressure regulation. It will accurately regulate at any pressure between the initial pressure and atmosphere in one stage, operating control valves from ½" to 6".

For Reduced Pressures	*Specify*
2 to 15 lb.	ATLAS 801
0 to 5 lb.	ATLAS 801-8
15 to 150 lb.	ATLAS 802

Ask for Bulletin No. 1 B which tells all about ATLAS Super-Sensitive Pressure Regulators. Use the coupon below, at the same time checking for information on other ATLAS products.

ATLAS VALVE COMPANY

REGULATING VALVES FOR EVERY SERVICE

289 South St., Newark 5, N. J.

Represented in Principal Cities

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☐ Thermostats
☐ Balanced Valves
☐ Control Valves
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Street .....

City ..... State .....

Water Pollution

(*Continued from page* 109)

circuiting, etc, can nullify the effectiveness of an otherwise good control system. When good instrumentation is designed into the original plant, first cost and subsequent operating costs are likely to be significantly lower. Of course, instrumentation can be added to an operating plant advantageously, but it will cost more or be less complete than if installed originally.

JOHN E TARMAN, *W H & L D Betz*

A consulting engineer engaged in solving a waste-treatment and disposal problem has three responsibilities: (1) to his client to develop the most economical method of obtaining a satisfactory effluent (2) to the public-health authorities to comply with their regulations and (3) to the community where the plant is located, to avoid setting up any local nuisance.

When a plant is completed, the consulting engineer must instruct the operators in suitable control and operating procedures because a plant's design is no better than its operation. This also means that the plant should be designed so it is easy to control, operate and maintain.

INSTRUMENT MANUFACTURER

LOUIS GESS, *Brown Instruments Div, Minneapolis-Honeywell Regulator Co*

In trying to plan instrumentation for waste disposal in customers' plants, instrument manufacturers faced these problems:

1. Process of waste treatment and its instrumentation were both new and in many plants unfamiliar to available personnel.

2. Design of a waste-treatment plant to produce the desired result requires engineering services beyond those available in most customer personnel.

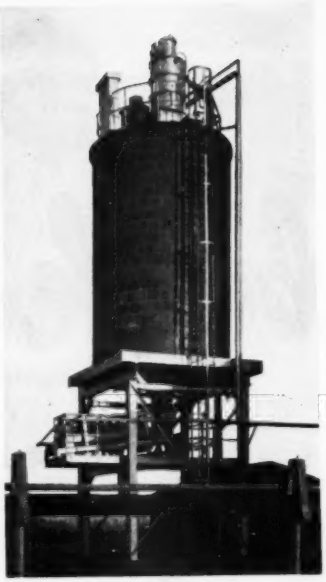
3. Many processes required to alter waste to comply with legal requirements were as complicated as those required to produce the marketable product.

4. It was sometimes impossible to use existing sewage-disposal facilities because they were too small or unsuited to take the specific waste material. Ultimate disposal of the finished product was left for the manufacturer to solve.

In approaching the problem of waste disposal, we've had not only to study legal requirements but also to compare treatment processes with other industrial processes to see how existing methods of instrumentation and control could be applied to waste disposal. But in many cases while available instruments and controls required at most only minor modifications, the functional and physical design of the waste-treatment process itself was beyond the scope of our engineering services, and we've had to turn to consulting engineers to supply the technical knowledge to design the mixing chambers, settling basins, etc, and correlate engineering between manufacturer and user.

How Instruments Are Used. In general the same variables are to be measured in waste control as in other continuous-process operations. But some modifications must be made.

Flow. Main problem here is getting good ratio control between fluids to be treated and neutralizing solution. Often wastes come



3 Years of Rugged Service for American Cyanamid

The National Ash Conveyor system shown was installed 3 years ago at The American Cyanamid Company plant in Newcastle, Pa. Its performance during this time is ample proof of the sound engineering and wear-resistant materials that go into our equipment. We now are installing a second unit at the Bridgeville plant of the same company.

NATIONAL — *"a good company to work with"*

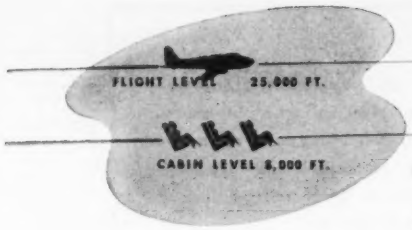
National does not consider a completed installation its final responsibility . . . expert servicing for National Systems is always available. A free yearly check-up and quick delivery of replacement parts, from fully adequate stocks, is part of our service. A 25-year record for promptness and dependability has made strong friends of our many clients.

• *Send TODAY for informative catalog illustrating typical applications.*

NATIONAL CONVEYORS COMPANY, INC.

50 CHURCH ST., NEW YORK 7, N.Y.

Manufacturers of The National ChipVeyor System for Metal Turnings – Furnace Doors – Feeders – Ash Gates and Related Equipment



In modern air-liners you breathe comfortably at altitudes of 25,000 ft., because your cabin is "Pressurized" — air pressure inside the plane is kept at or near normal sea level pressure.

Boilers, too, "breathe" easier when their combustion air is "pressurized" using forced draft

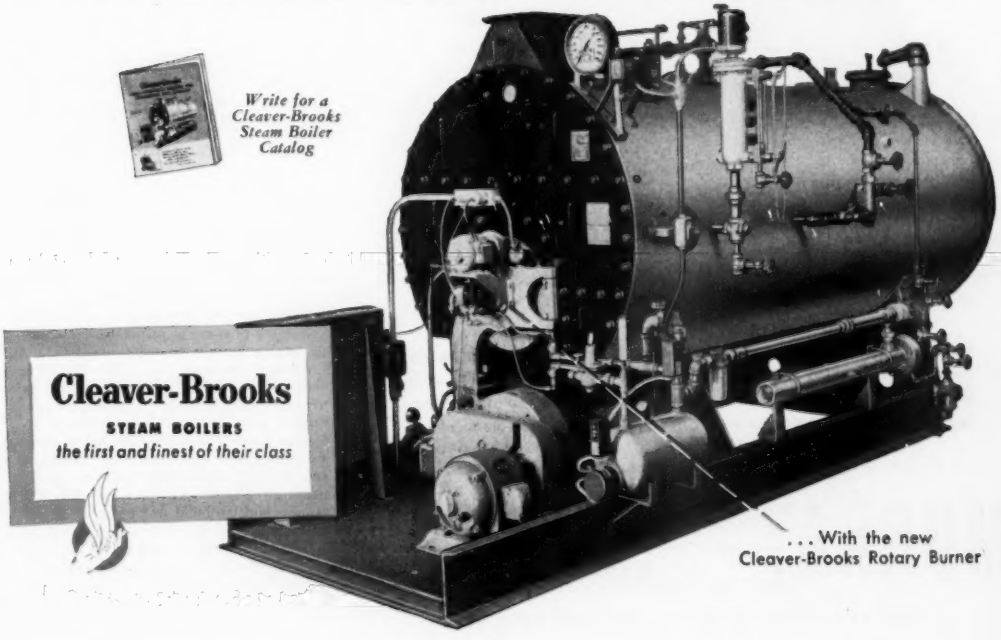
Cleaver-Brooks experience with thousands of steam boilers, of the self-contained type, has conclusively proven these operating advantages of forced draft:

- — because atmospheric boiler-room air is constant in temperature and therefore in density, the weight of air delivered for combustion by a forced draft fan is also constant and always gives proper air-fuel ratio (CO_2) resulting in maximum efficiency and freedom from combustion problems.
- — the electrical load, or power requirement, of a forced draft fan is at a minimum, because the fan handles a lesser volume of air.
- — low fan maintenance and longer fan life with forced draft fans since they operate with cool, clean boiler room air — no problems with high bearing temperatures and corrosion.
- — air is under pressure in the combustion chamber of a forced draft boiler, with no possibility of "diluting" air entering the chamber. Maximum boiler efficiencies are always attained when head plates and casings are tight.
- — lower initial fan cost, better space arrangement, and better appearance are gained because forced draft fans are considerably smaller.
- — casings for forced draft fans are cool — require no insulation — contribute to safer operation and cooler boiler rooms.

Forced draft is one of many reasons why you get a greater return from your investment in a Cleaver-Brooks boiler — a boiler of foremost quality in every detail and with many immediate and long-range cost-saving features. Cleaver-Brooks self-contained boilers are available for oil, gas, combination oil and gas firing — 15 to 500 hp., 15 to 250 lb. p.s.i.

CLEAVER-BROOKS COMPANY
332 E. Keefe Ave., Milwaukee 12, Wis.

Write for a Cleaver-Brooks Steam Boiler Catalog



. . . With the new Cleaver-Brooks Rotary Burner

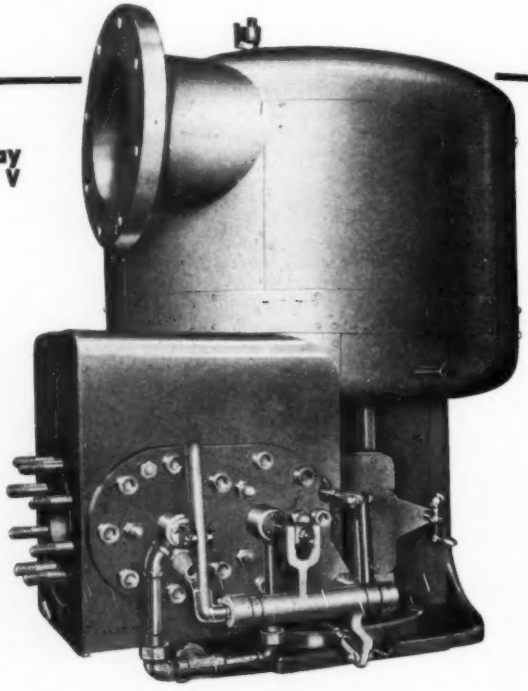
WHY NOT TURBINE DRIVE?

Pumps, fans, compressors, special processing machines, in fact almost any machine requiring driving power can be fitted with an economical and dependable steam turbine driver selected from the many types available.

Steam turbines provide safety, low maintenance expense and ability to operate for long periods without inspection. Unsheltered installations are highly practical.

A large selection of types and frame sizes, special features and accessories are available on short delivery to suit your application.

Murray Type V



Among the newest in the Murray turbine line is the Type V vertical turbine, above. This machine provides completely enclosed construction, either direct-connected or geared for vertical pumps up to 600 HP and beyond. See that your new vertical pump is driven with a Type V steam turbine.

Contact your nearest Murray representative or write direct to—

MURRAY IRON WORKS COMPANY

BURLINGTON, IOWA

Builders of Steam Power Equipment for Three Quarters of a Century.

from several processes whose operation cannot be synchronized to provide constant or balanced flow to the treating fluids. Presence of sediment or corrosive fluids also add to the problem.

Effective ratio control with flow varying widely can be accomplished by proper selection of secondary measuring devices such as linear flowmeters or rotameters and, if necessary, by using multiple primary elements with automatic or semi-automatic switching between them.

For measurement of fluids carrying sediment, two from other fields are used. One is the sewage-type venturi tube. The other uses a venturi with a purge system developed to measure catalyst in the petroleum industry, which keeps the meter body connecting system from plugging. Purges are also used for corrosive fluids.

Weirs and flumes are useful too, particularly the Parshall flume originally designed to measure irrigation water.

Discussion

W N GREER, *Leeds & Northrup Co*

Certain factors should be considered in measuring and controlling pH:

1. Set-point, or pH of treated waste.
2. Acidity of waste before treatment and the rate of change of acidity from minute to minute, or over short periods of time.
3. Flow rate and variations of flow rate.
4. Retention in treating system.
5. Detection lag.

Briefly, the greater the difference between the pH of the incoming waste and the required pH of the treated waste, the more difficult the control. The reason is that a given percentage change in the acidity of a low pH raw waste makes a greater reagent demand change than does the same percentage change in acidity at a higher pH value. Also, the larger the flow rate or variation in flow, the greater the required retention and the shorter the detection lag must be to insure right discharge pH.

JOHN G DOBSON, *Utility Industry Div, The Foxboro Co*

While application engineers of the instrument manufacturer can help the waste-treatment plant designer, the problem of long-term analysis of the waste products to determine their concentration and variation, is a job that can be done only by an engineer assigned to the task over a period of time, be he a consultant in the field or one of the industry's own engineers.

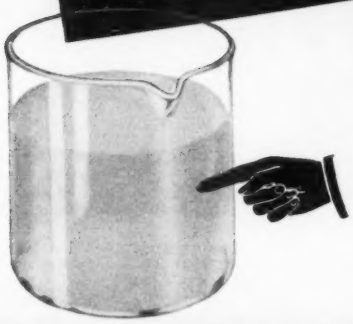
These surveys should always be made before the pressure of enforcement authorities makes haste a necessity.

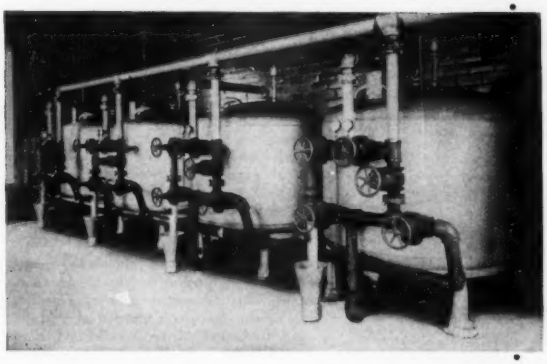
Another problem that exists is while chemical and sanitary engineers tend to think of industrial-waste disposal as a continuous process, the wide variation of incoming wastes has made a number of State authorities wary of continuous treatment and in many cases they insist on batch-treatment plants, which can be quite expensive both to build and operate. A full appreciation of the reliability of modern industrial instruments will make approval of more continuous treatment plants possible, when similar plants not properly instrumented would not meet legal codes.

(*Continued on page* 200)

A GRAVER FILTER

makes the difference





Does your water supply contain sediment . . . silt . . . organic matter or other suspended solids, fine or coarse? Is it ever cloudy or colored?

If so, Graver has the remedy . . . not just a single design of filter offered for any and every clarifying need, but a complete range of filters to include exactly the right unit for each kind and amount of suspended matter.

Graver Filters include pressure and gravity types; sand and gravel, Anthrafilt, and diatomite filtering media; and special designs for removal of iron, oil, taste and odor. Moreover, Graver Filters can be arranged to correct certain other water conditions, such as low pH; and can be combined with other Graver apparatus for additional water conditioning, such as removal of hardness.

Many thousands of Graver Filters are installed all over the country, in plants of every industry, and serving every filtering need.

Whatever may be your water conditioning needs, you can depend on Graver's 40 years of experience and Graver's modern, efficient designs. Your request for advice and specific recommendations will not involve the slightest obligation.

GRAVER

GRAVER WATER CONDITIONING CO.

Division of Graver Tank & Mfg. Co., Inc.

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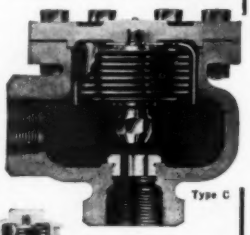
GW-432

Nicholson Makes

Freeze-Proof Steam Traps

for Every Plant Use

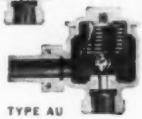
Because they drain completely when cold, these four types of Nicholson steam traps are positively freeze-proof. Can be freely installed outdoors. Universally recommended for use in lines which need not be in continuous use during cold weather, because they are freeze-proof and because their 2 to 6 times average drainage capacity results in minimum heat-up time. The non-air-binding feature of Nicholson traps also notably facilitates steam transfer in severe weather.



Type C

TYPE A

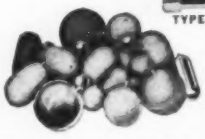
TYPE AHV



TYPE AU

Four types: size ¼" to 2"; press. to 225 lbs.

BULLETIN 450.



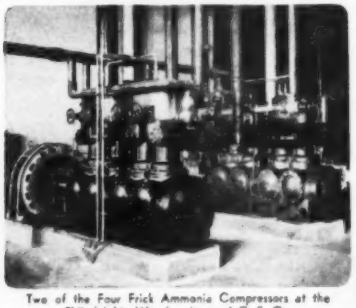
HIGH-PRESSURE FLOATS—Stainless, monel, steel or plated steel. Welded. In all sizes and shapes; for operating mechanisms and as tanks or vessels. 2-day delivery. BULLETIN 650.

W. H. NICHOLSON & CO., 125 Oregon St., Wilkes-Barre, Pa.

BIG COLD STORAGE MODERNIZES with

FRICK Refrigeration

The three buildings of the Philadelphia Warehousing and C. S. Co. occupy a city block along the Delaware River water-front. Until recently the cold storages were cooled with steam-driven refrigerating machines installed in 1890 and 1911.



Two of the Four Frick Ammonia Compressors at the Philadelphia Warehousing and C. S. Co.

Today the cooling load is carried by four new Frick compressors, driven by electric motors totaling 775 hp. A battery of large shell-and-tube brine coolers were included in the modernization program.

Let us submit estimates on the up-to-date cooling equipment you may need: write, wire, phone or visit

DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA. U.S.A.

Also Builders of Power Farming and Sawmill Machinery

GOVERNMENT'S VIEWPOINT

(*Continued from page 198*)

J RAYMOND HOFFERT, ***Chief Engineer, Pennsylvania Dept of Health***

The Government is interested in increased instrumentation in industry because it has a vital bearing on the success with which we can prosecute our stream-pollution abatement problems. A well-instrumented industry should have available much of the data needed to deal with its disposal problem.

I am convinced that pollution abatement is as much a matter of education as of law enforcement. It's surprising how little some industries know about what goes down their sewers.

Steel Mill. One steel mill, for example, after being forced to install settling devices for its blast-furnace flue dust, at a cost of $516,361, saved in one year after paying for operation and for sintering of the ore dust, $580,636. After that they went out and dug up 15,000 tons of dust already sent to the river. Now there is a reduction of 13 grains of solids per gallon of waste water —145 tons a day.

Food Plant. Officials of a large factory didn't think they were causing any substantial pollution until our B.O.D. tests showed them that 3200 lb of milk and 800 lb of sugar a day were going down the drain from what they thought were efficient evaporators.

Not Always Savings. I do not wish to give the impression that profits will always result from proper waste treatment. More savings *will* occur as greater study is put to the problem of waste disposal, but often expenses of disposal at best break even.

Self-Protection. Why should industry go to the expense of installing elaborate instrumentation? Simply for its own protection, to keep itself informed as to just what it is throwing away and as a defense against charges it is injuring others.

Needed Instruments. Officials who must administer anti-pollution laws are becoming increasingly interested in stream-monitering devices by which unusual or surreptitious discharges can be detected and traced to their source. Those available at present are limited in scope and expensive.

Discussion

L H ENSLOW, ***Editor, Water & Sewage Works***

Instrumentation in industrial-waste disposal is just in its infancy; there's a wide-open field for inventive ingenuity. But it's my thought that instrumentation is of greater importance back in the process the waste comes from. More instrumentation here would not only save production costs but also would make it unnecessary to remove wastes that could be avoided.

As for standards for plant effluents. Most standards set up will probably always be on the "safe side" and unjustifiably expensive to industry by and large with treatment costs beyond actual needs. The only true standard that can be defended and enforced by any authority is the *stream condition* and *water quality* standard. The end result that counts is the stream itself. Any workable standards applied to plant effluent can only be rudimentary to establish primary objectives.

This Exide Battery is cranking thousands of your engines, Mr. Diesel

When your engines first came into general use, Mr. Diesel, its high compression ratio made cranking a major problem. Exide engineers solved it by building a battery designed specifically for the job.

To engine builders . . . and manufacturers of Diesel-powered equipment . . . and users of Diesel engines . . . this means: When an Exide does the cranking, your engines START.

You can count on a *quick breakaway, high cranking speeds, low voltage drop.*

You can count on trouble-free performance . . . in rugged service . . . in all climates.

You can count on long battery life and low cost maintenance . . . proved daily in buses, trucks, trailer tractors, off-the-highway equipment, ships, power plants, Diesel-electric locomotives.

For dependable service at a saving, use Exide Diesel-cranking Batteries.

THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

WHATEVER YOUR CRANKING PROBLEMS
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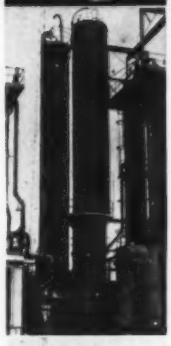

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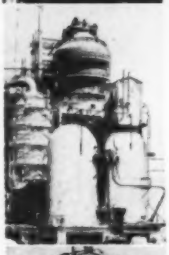

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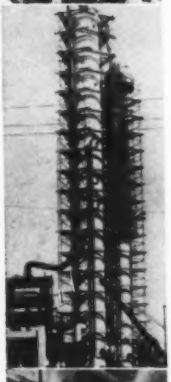

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With Our Readers

(*Continued from page 5*)

meter read zero we knew the motor rotation was OK.

Then as a double-check, a voltage reading was taken across all motor leads before closing in the machine on the line. Remember there's always the outside chance the motor feed may have been dead during the test. Of course you'd then get a zero reading on the series pt voltmeter.

Watsonville, Calif. E E JONES

"5000 OLD LADIES . . ."

Being in the editorial business and knowing engineering also, POWER *editors probably get even more of a kick than I do out of what happens when a writer tackles a technical subject and gets tangled in its meshes. The following, from a popular magazine article, illustrates what I mean:*

"This was the forecast, but any unforeseen happening would disturb it. If a sudden cloud appeared, 20,000 office workers might casually turn on the lights and the L. D. was responsible that those unexpected lights should neither flicker nor be dim. If the evening was warmer than usual, 5000 old ladies might decide not to plug in the electric heater, and the L. D. was responsible that this unused energy did not flood the system and disarrange the delicate continuous process in operation at the Consolidated Paper Mill."

It's the picture of those 5000 old ladies not plugging in their heaters and the load dispatcher wrestling with all that unused energy that gets me. Sure, a sudden big drop in load might give governors a rough time and jiggle the frequency a bit, but I've never seen a power system yet that got into trouble because of a load that just didn't materialize.

Atlanta, Ga. A J BUTLER

ENGINEER'S BOOKSHELF

(*Continued from page* 168)

power transmissions, materials handling, lubrication and other functions.

Power-plant section gives a broad general treatment in 300 pages. Beginning with thermodynamics, it considers fuels, boilers, steam turbine-generators, gas turbines, compressors and pumps, hydraulic turbines, mechanical drive turbines. Those interested in gas turbines will find their operating principles, application and maintenance comprehensively covered.

The authors are men of broad training and experience from 46 leading industrial organizations and five universities in the U. S. They have produced a book for constant reference and increased understanding of basic problems and best methods of running a plant.

ELECTRICAL TRANSMISSION AND DISTRIBUTION REFERENCE BOOK (*revised*). *By Central Station Engineers of Westinghouse Electric Corp, East Pittsburgh, Pa.* 9x11, 824 *pp*, $6.

This edition follows the general style and character of the original book but all material has been carefully revised and three new chapters added. In nine years this has become the standard reference in this field for many engineers in the electric

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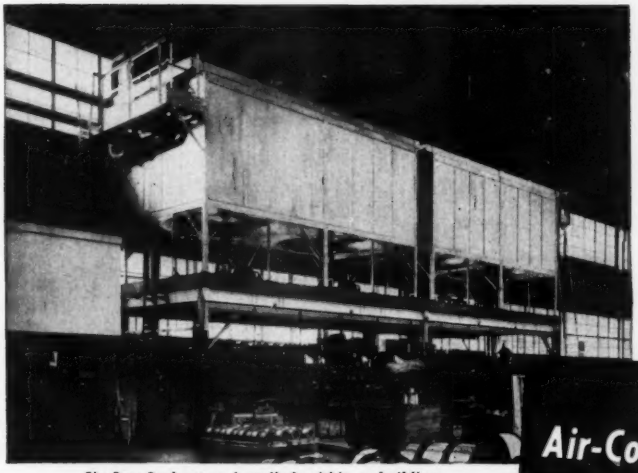

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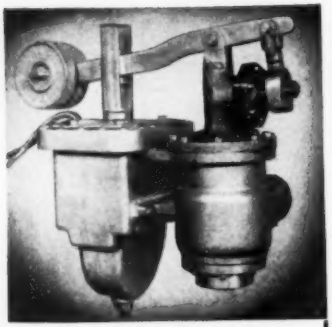

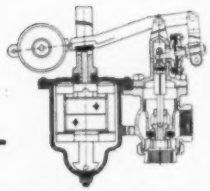

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Fig 12

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power industry and for students of electrical engineering.

Book is divided into 23 chapters including symmetrical components, characteristics of aerial lines, power transformers and reactors, machine characteristics, excitation systems, application of shunt capacitors, relay and circuit-breaker applications, etc.

SNOW MELTING, *by T Napier Adlam. 9¼x-5¼, 224 pp, 189 illust, cloth.* **$4.50.** *The Industrial Press, 148 Lafayette St, New York 13, N. Y.*

SNOW MELTING of limited areas like sidewalks, and driveways, and of roads, can be accomplished by circulating hot water through pipe coils embedded beneath the road or walk surface. Antifreeze solutions prevent freezing of the liquid when the system is shut off. Still another method uses buried electrical cables, but it is far less popular.

This new books covers not only design of such systems but also data on amount of snowfall, air venting, pipe friction, pump selection, coils of installing and operating.

There are 27 full-page working charts that are considered great aids in covering all types of construction. Their presence speeds up the job of computing pipe sizes and spacing.

MODERN AIR-CONDITIONING, HEATING AND VENTILATING *(2nd edition), by W H Carrier, Realto E Cherne and W A Grant, 7x10, 574 pp, illust, cloth.* **$10.** *Pitman Publishing Corp, 2 W 45th St, New York 19, N. Y.*

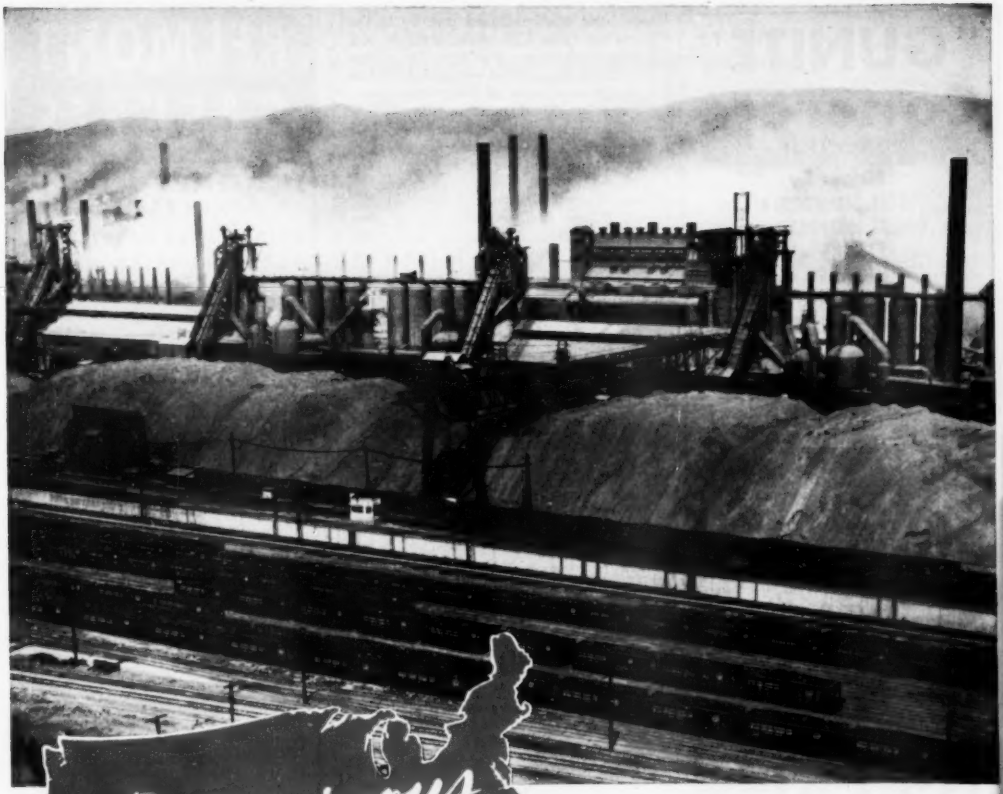
BECAUSE THE ART OF HEATING, ventilating and air conditioning has moved so fast in the last decade this second edition has been brought out. The book is designed to apply existing theory to actual practice in the industry.

Much of the material has been used by the authors and their associates in the Carrier Corps schools for training technical graduates for application-engineering assignments. This proving ground should be of considerable value to the student, the industry in general and the installation contractor since it vouches for the practical nature of the book.

COAL-PREPARATION, *edited by David R Mitchell, 6x9, 830 pp, illust, cloth.* **$8.** *American Institute of Mining and Metallurgical Engineers, 29 W 39th St, New York 18, N. Y.*

Coal preparation today is an art—and a rapidly moving one. The need for better and more thorough preparation has been growing and bids fair to continue at an accelerated pace. As the quality of coal decreases and mechanical means for its mining increase, more elaborate preparation equipment has to be kept coming along to market an acceptable item.

During the last 10 or 15 years the development of this class of equipment and its application has been so fast that even the Proceedings of the various technical societies have failed to keep pace. This book as originally prepared was an attempt to consolidate some of the gains by describing as nearly as practicable the



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very latest equipment and practice to the operating man. This same laudable aim prompted the present edition. Its editors have been drawn from recognized leaders in the various phases of coal preparation.

There are 23 chapters in all, covering everything from the economics of coal preparation, sampling, screening and specifications to plant control and efficiencies.

POWER-SYSTEM STABILITY (1950), *by Edward Wilson Kimbark, professor of electrical engineering, Northwestern University. 228 pp, 6x9, illust, cloth.* $8. *John Wiley & Sons, 440-4th Ave, New York 16, N. Y.*

This is Volume II of a 3-volume work on power-system stability, intended for power-system engineers and graduate students.

Treatment is down-to-earth and practical so it is also useful to persons interested in power-system protection even if they are not concerned with stability problems.

The book covers power circuit breakers and protective relays, including material on rapidly reclosing circuit breakers and on performance of protective relays during power swings and out-of-step conditions. Both 3-pole and selective-pole tripping and reclosure are discussed, including their effects on system stability.

REFRIGERATION ENGINEERING, (*2nd edition*), *by H J Macintire, late professor of refrigeration, University of Illinois, and F W Hutchinson, professor of mechanical engrg, University of California. 610 pp, 6x9, 211 illust, many full-page graphical solutions, cloth,* $6.50. *John Wiley & Sons, Inc, 440 Fourth Ave, New York 16, N. Y.*

This widely used book has been expanded to make it more useful to both students and practicing engineers. About one-half the material is new. Eight chapters and over 70 illustrations have been added. There are more than 200 problems, 160 being new.

The three parts are: thermodynamics of reversed cycles, load determination, and refrigeration equipment. The large number of illustrations, charts and problems make this a worthwhile contribution to the field. Included are a wide variety of applications in various fields and typical cooling and freezing requirements. A few topics discussed after consideration of elementary concepts are: heat pumps, adsorption and absorption systems, refrigerants, heat transfer, air conditioning, duct design, compression machines, condensers, evaporators, piping, brine cooling, cold storage and ice manufacture.

Engineers interested in refrigeration theory, calculations and application will find this a good tool. Erection, operation and testing are covered but briefly; a more comprehensive discussion would make the book more useful to plant operators.

MODERN ARC-WELDING LESSONS, *Chapters XII to XXI, Hobart Trade School, Inc,* 5½ x8, 431 *pp, illust, leatherette binding:* $3. *Hobart Trade School, Inc, Box EW-157, Troy, Ohio.*

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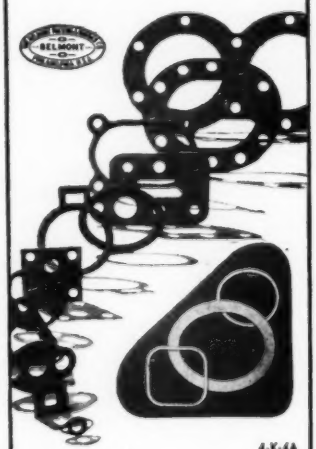
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COPPER ALLOY BULLETIN

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Open-type pre-heater used in laundry. Both the wash and rinse water flows into the tank by gravity. Fresh water flows in the opposite direction through the copper tubes and into the storage heater where this preheated water is raised to the temperature needed for the wash. Courtesy Whitlock Manufacturing Co., Hartford, Conn.

Recovery of Waste Heat Means Savings in Fuel Costs

Every gallon of hot waste water pouring down the drain represents a loss of fuel or energy.

Where the temperature differential is great, recovery is easy with present-day heat exchangers. However, when the difference is small, the problem of recovery is very great and remains to be economically solved.

Take for example a laundry: for every 10 gallons of 160-degree wash water pouring into the sewer, about one pound of coal or ¾ of a pint of fuel oil was needed to obtain such a temperature. Plants running a large volume of water each month can show sizable savings through the use of waste heat reclaimers—heat exchangers. Not only can heat be recovered from the wash water, in this case, but also from the rinse.

Flash Steam Utilized

Another interesting example of how engineers have recovered heat to effect large savings is seen in a paper mill digester. Since this operation is done at high temperatures in sealed units under pressure, flash steam is released when the unit is opened after completion of the process. This steam is passed through a tube and shell exchanger and the transferred heat is used to preheat fresh water.

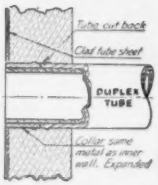
Other industries now utilizing waste heat in processes or from waste water include: textile mills, power plants, refineries, and chemical processing. Some concerns have also used the heat from diesel engine exhaust to preheat water or to heat a plant. Mills have utilized the hot water produced in quenching tanks for heating.

Duplex Tubes Used

Coils in open-type exchangers, and tubes in the closed type, are either of copper or a copper-base alloy depending on the waste media involved. In many cases, Duplex tubes are required when two different corrosive liquids are involved. Combinations of Admiralty, aluminum brass, copper, cupro nickel, aluminum bronze, Muntz metal, yellow brass, Naval brass, silicon bronzes, aluminum, lead, nickel, low carbon steel, stainless steel, alloy steels and tin are possible in Duplex tubes.

Duplex Tube Collars Supplied by Bridgeport

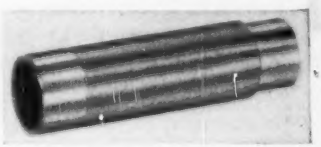
One of the most serious objections raised by prospective users of Duplex tubes is the possibility of galvanic corrosion. The seriousness of this condition varies with the character of the liquid, the Duplex tube combination, composition of the tube sheet, and water boxes of the heat exchanger. One of the answers to this problem is collars or ferrules of the same material as the inner component of the Duplex.



Collar of the same composition as the inside of the Duplex tube, and similar to the tube sheet, is shown assembled in tube sheet to prevent galvanic corrosion.

As a pioneer manufacturer of Duplex tubes, Bridgeport has been supplying cutback tubes and collars to fabricators. These collars have either been shipped separately or attached to the tubes depending on the desires of the fabricator. In recent years more and more concerns have asked to have these collars attached.

Although many manufacturers of heat exchange equipment have cutback tubes and attached collars, a close analysis of costs in their own shops will very likely show that Bridgeport's cost on this work will be competitive since necessary equipment is part of our regular production program.



Illustrating Duplex tube, both ends cut back; with sleeve attached to one end.

For further information on installation and use of Duplex, write for Technical Bulletin No. 1950. (6262)

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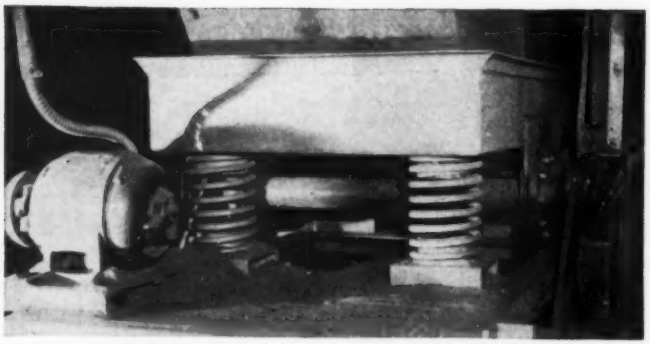

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Fully mechanical vibrator. Simply constructed . . . only four bearings and an eccentric shaft. Completely dust-tight, impervious to heat and cold, practically noiseless.

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style suitable for a course in home study.

The book starts off at Chapter XII with a rather detailed presentation of preliminary instructions, which cover such subjects as courtesy on the job, avoiding waste, and daily procedures, largely of interest to students at the school.

From Chapter XIII on, however, the book gets down to cases. Every step, as well as possible missteps, is described and illustrated, where possible by both line drawing and photograph. All in all the book is of definite interest to the student of welding.

Many sections have had a thoroughgoing revision. New tables of basic data have been added, oil burners and their applications brought up to date, engineering data worked in on panel heating, new techniques included for air cleaning and purification. The section on psychrometrics has been entirely rewritten. The Carrier Psychrometric Chart is featured.

MECHANICAL ENGINEERING LABORATORY. *By C W Messersmith, professor of experimental mechanical engineering, and C. F. Warner, associate professor of mechanical engineering, Purdue University.* 160 *pp. illust,* 11¼x8½, *paper cover,* $3.50. *John Wiley & Sons, Inc,* 440 *Fourth Ave, New York* 16, *N.Y.*

This plastic-wire-bound book outlines the information needed by mechanical engineering students before they perform experiments on specific types of prime movers and apparatus. The first chapter discusses: purpose of the course, how to prepare for an experiment, how to run it, precision of measurements, how to calculate, and acceptable procedures in preparing a report.

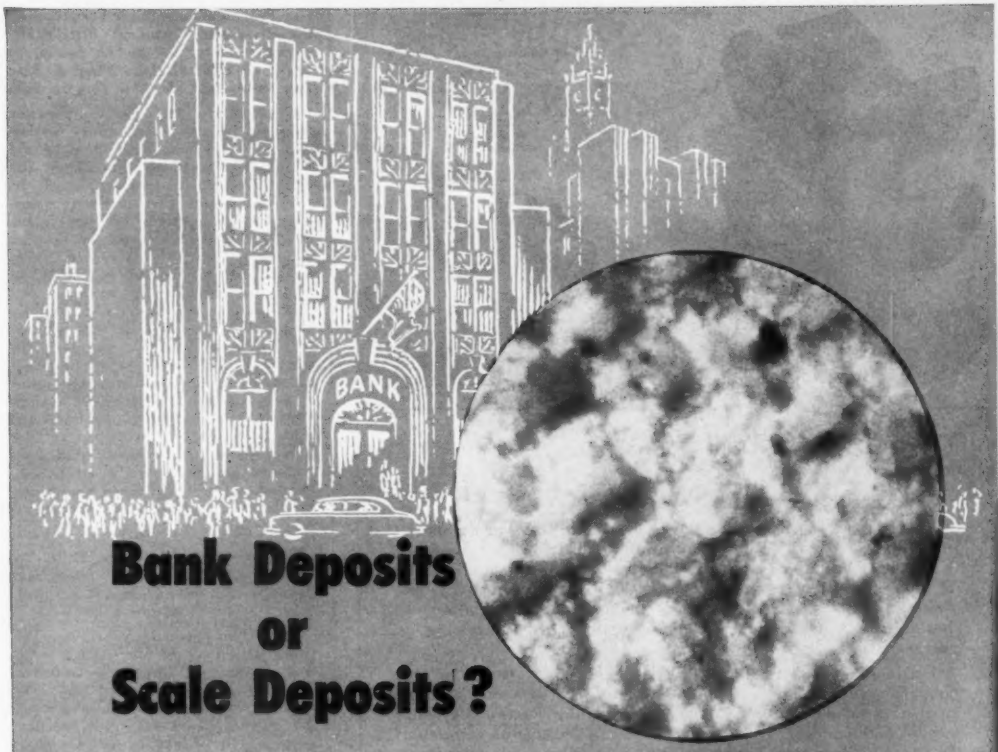
The book covers measurements of: pressure, temperature, power and flow; heating value of fuels, properties of lubricants, flue-gas analysis, pumps, steam-generating units, prime movers, heat transfer and the compression refrigerating plant.

PROCESS HEAT TRANSFER. *By Donald Q Kern, director, Process Engineering Division, The Patterson Foundry & Machine Co,* 871 *pp, illust, tables,* 9¼x6½, $8. *McGraw-Hill Book Co,* 330 *West* 42*nd Street, New York* 18, *N.Y.*

Written for undergraduate and graduate engineering students, this text presents the subject of heat transfer in the terminology and methods of practical industry. Combining both theoretical background and modern practice the book uses a new approach to solving problems met in the chemical and mechanical process industries. A number of empirical calculating methods are given, which have not previously appeared in engineering literature. Some material, included in conventional heat-transfer texts but seldom used in practice, has been omitted.

Chapter headings include: Conduction, convection, radiation, temperature, double-pipe exchangers, shell and tube exchangers, gases, streamline flow and free convection, condensation of single and mixed vapors, evaporation, extended surfaces, direct-contact transfer, cooling towers, batch and unsteady state processes, furnace calculations, control.

(*Continued on page* 210)



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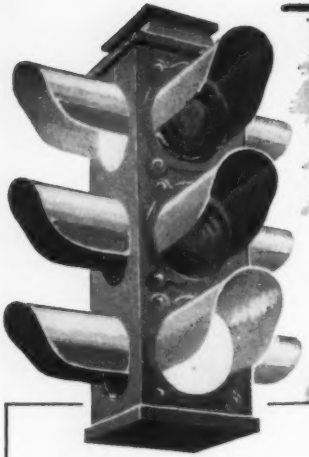


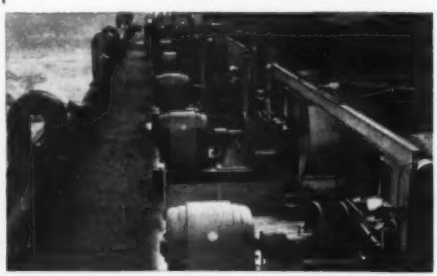
DRAFT FANS GO on GREEN

A Big Draft Job Handled Capably by Green Fans

Twenty-four large Green Fans take care of a heavy draft load at the Venice (Illinois) Plant of the Union Electric Co. of Missouri. Each of six boilers has two sets of Green Fans, each set consisting of one induced draft fan and one forced draft fan coupled to one motor as a unit. With the heavy demands on this station, all boilers are usually in service continuously, thus throwing an unrelenting burden on the fans.

Engineers whose responsibility it is to recommend or accept draft fans for large power plants certainly want efficiency and low operating costs. But they don't overlook the maintenance and replacement angles. They want the sound designs of competent experienced fan engineers. They also want the care in construction that is found in shops of a company that has built up an international reputation as the "authority" on draft fans. They know that such a company will not tolerate sloppy shop work.

Green is this authority on mechanical draft fans.



Have You a Copy of Our Fan Bulletin No. 168? If not, we shall be glad to send you one.

THE GREEN Fuel Economizer COMPANY INC.

BEACON 3, NEW YORK

ECONOMIZERS • FANS • AIR HEATERS • CINDERTRAPS

GAS PRODUCERS AND BLAST FURNACES. *By Wilhelm Gumz, Consultant, Battelle Memorial Institute.* 316 *pp,* 66 *figures,* 84 *tables,* 8¾x5¾, $7. *John Wiley & Sons, Inc,* 440 *Fourth Ave, New York* 16, *N.Y.*

Gasification of fuels has an increasing industrial importance because of development of the synthetic-fuel industry and the expected advances in metallurgy. Gas technology and furnace design, largely developed empirically, need better evaluation of their operation and application. This book develops theories and calculating methods that should reduce experimental time and cost as well as aid in more rational design of practical equipment. Several solutions are offered for mathematical treatment of various problems. Practical cases are presented numerically to prove generally close agreement of calculation and measurement as well as to display the general applicability of the methods to gas producers and blast furnaces.

Topics covered include: gasification reactions, gas composition at equilibrium, composition at incomplete equilibrium, calculation methods, reaction kinetics.

POWER. *By Martin Ruhemann, Ph.D.,* 123 *pp,* 7½x5, *illust,* $1.25. *Interscience Publishers, Inc,* 250 *Fifth Ave, New York* 1, *N.Y.*

An elementary nontechnical book on power generation for the layman. The book has been written in England with characteristic British technical terms. The author attempts to explain steam turbine and internal-combustion engine operation in words only, without the use of a single illustration. The explanation will undoubtedly be clear to readers familiar with engine construction, but we fear the uninitiated will be left in the dark.

The author's philosophizing and brief historical sketches enliven the book for all readers. Topics discussed include: work and force, machines, energy, water power, coal, oil and chemistry, electricity, heat engines, power and civilization.

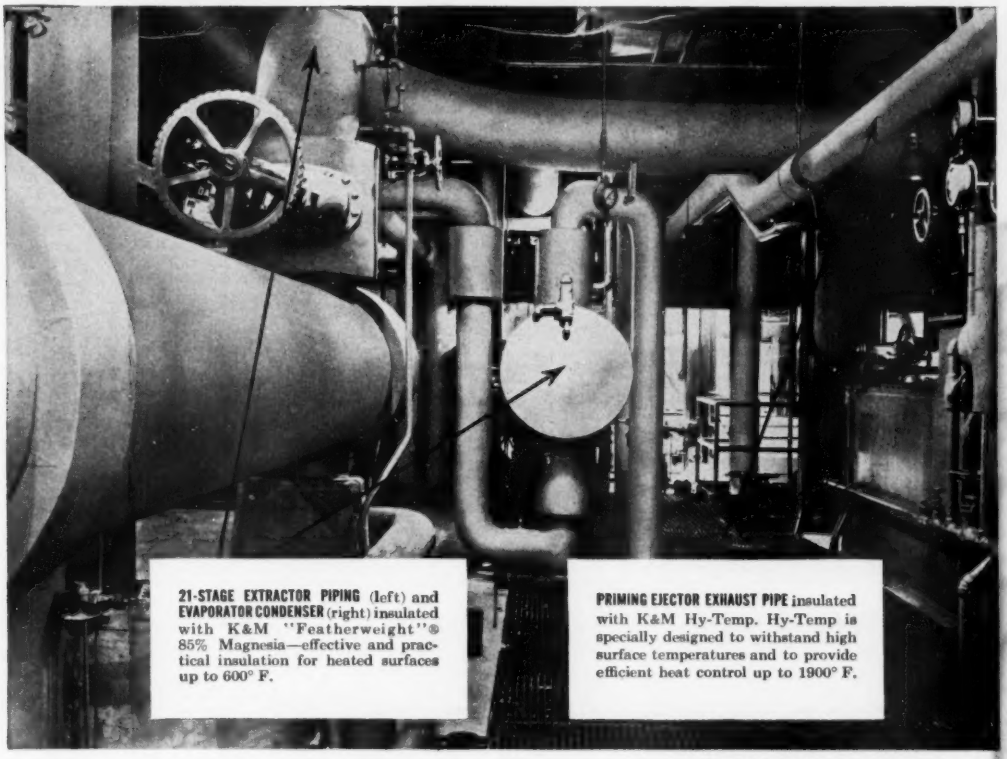
MODERN REFRACTORY PRACTICE (*3rd edition*). *By Harbison-Walker Refractories Co.* 439 *pp, illust, tables,* 11x8½, *free to users of refractories, libraries, heads of engineering school departments;* $3 *to engineering students;* $6 *for general distribution. Harbison-Walker Refractories Co, Farmers Bank Building, Pittsburgh* 22, *Pa.*

This volume combines a practical engineering handbook, technical treatise and a catalog of the company's products. There are scale drawings of 20 types of furnaces, which were prepared with cooperation of furnace designers. The drawings show detail and types of refractories generally used and, in some cases, alternate types for special conditions. The general discussions about each type of refractory should be helpful to furnace operators.

Refractory properties are explained in respect to mineralogy, stability at high temperatures, physical and chemical characteristics. This edition contains much new material not previously published.

Where the best in insulation is a must

Public Service Co. of Oklahoma uses
K&M Insulations in Weleetka Power Station



21-STAGE EXTRACTOR PIPING (left) and **EVAPORATOR CONDENSER** (right) insulated with K&M "Featherweight"® 85% Magnesia—effective and practical insulation for heated surfaces up to 600° F.

PRIMING EJECTOR EXHAUST PIPE insulated with K&M Hy-Temp. Hy-Temp is specially designed to withstand high surface temperatures and to provide efficient heat control up to 1900° F.

Insulation Contractor: Armstrong Cork Company

These K&M insulations keep steam hotter—longer—at less cost!

In power stations, oil refineries, chemical plants, factories, steamships, hospitals—in fact, wherever exacting steam control is a must—you'll find K&M "Featherweight" 85% Magnesia and K&M Hy-Temp Insulations. These two K&M products give you highly efficient, cost-cutting insulation in every service temperature range. And, for especially difficult heat control situations, the advantages of both are combined in K&M Hy-Temp Combination Insulation.

Your Keasbey & Mattison Distributor—who is an experienced applicator—will be glad to give you complete information on these or any K&M Insulations. Or, write us.

Nature made Asbestos...
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CHICAGO
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How to read with
your eyes open for business

Read the ads! Every issue of this magazine contains ads that offer valuable services and useful products by which your business may be run more profitably.

The time it takes to read all the ads is time well spent. One ad alone can pay off – by informing you of new developments and new sources of supply, by helping you do a more efficient job. For example, you may locate one machine that will cut your production costs, or step up your output. Or you may discover that the equipment you've been waiting for is now available.

This magazine displays more ideas and merchandise than a trade exposition. Make every issue your buyer's guide. Read the ads as well as the articles. That's reading with your eyes open for business.

HEADQUARTERS FOR BUSINESS INFORMATION

McGRAW-HILL publications

F-22

APPOINTMENTS

General Electric Co has announced the election of Ralph J Cordiner to succeed Charles E Wilson as president of the firm. Wilson, now chairman of the new Defense Mobilization Board, severed all connections with corporate and banking institutions when he resigned, including his positions as chairman of the board of General Electric Supply Corp, member of the board of directors of International General Electric Co, and the Guaranty Trust Co. He completed 51 years of continuous service with GE last November. Cordiner, who has been associated with GE for 24 years and has served as manager of 5 of the company's departments during that period, has been executive vice-president and a director of the firm since 1949.

Additional changes in the **GE** company are reported as follows: Henry A Vaughn replaces Herbert L Ross as manager of manufacturing of meter and instrument divisions at Lynn, Mass. Ross is now manager of River Works, also at Lynn. Dr William Carlton Davis becomes manager of marketing research of air conditioning dept.

F L Yetter is named senior vice-president of **C H Wheeler Mfg Co,** Philadelphia, Pa. He rejoins the company after a 20-month period during which he served as director of foreign affairs for Kuljian Corp, consulting engineers.

Worthington Pump & Machy Corp, Harrison, N. J., has made Wilbur R Leopold assistant to vice-president T Cruthers. Clarence S Wentworth has succeeded Leopold as manager of Worthington's Detroit office.

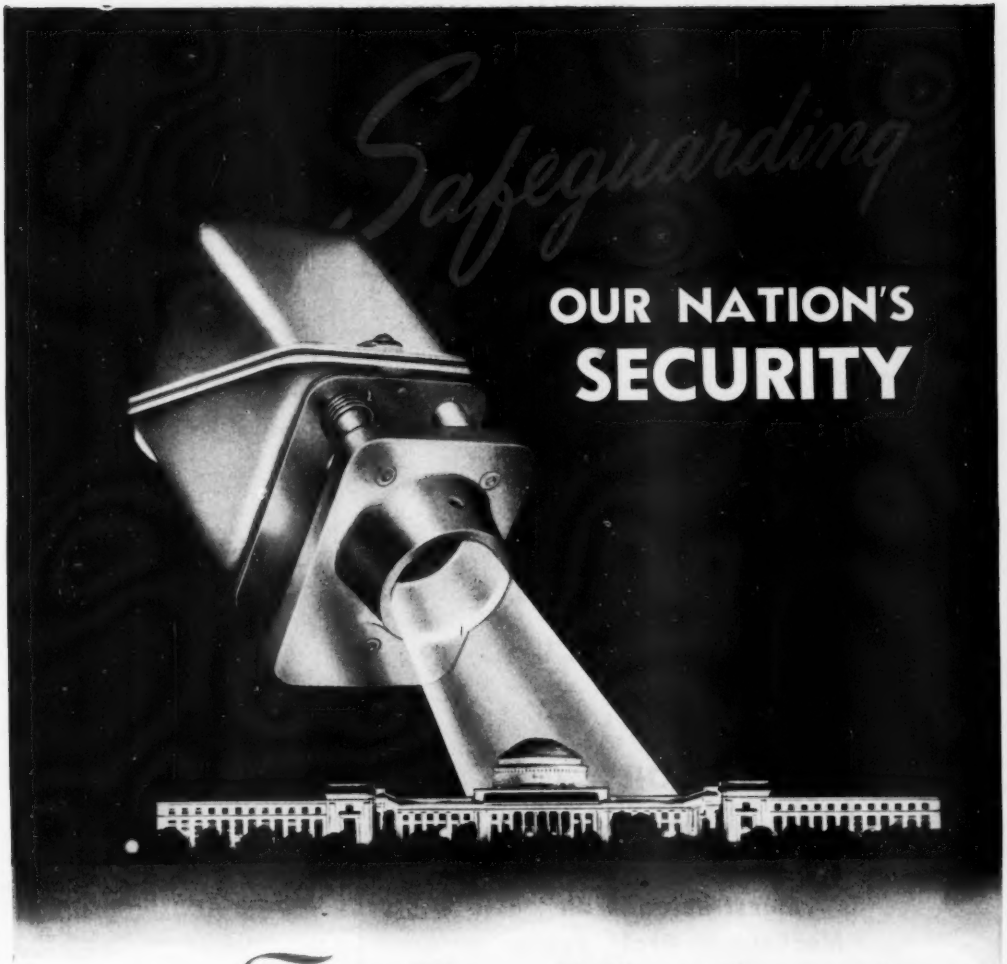
Frank Barilla is assigned to Cleveland district office of **Allis-Chalmers** as a water conditioning sales representative. N W Landis is named manager of Detroit district office succeeding F S Schuyler, who is retiring after 43 years of service. A J Mestier Jr replaces Landis as manager at Syracuse.

Thomas C Wilson Inc, Long Island City, N. Y., has chosen Tate Engrg & Supply Co, to handle sales of Wilson products in State of Maryland.

Farnsworth Chapin becomes sales manager of **Aquadyne Corp,** New York, N. Y., manufacturer of wetting compounds for industry.

Timken Roller Bearing Co, Canton, Ohio, announces appointment of Dwight A Bessmer as assistant to the president. Paul E Young succeeds Bessmer as director of purchases and R J Archibald is made assistant general purchasing agent.

William A Callison, vice-president, **American Locomotive Co,** has been assigned charge of eastern regional sales. William F Lewis has been made a vice-president and put in charge of western regional sales. Callison will make his headquarters in New York, and Lewis will transfer his office to Chicago. Also, Stephen G Har-



fireye **Flame Failure Protection**

At the Massachusetts Institute of Technology, where research is the order of the day, Fireye Flame Failure Safeguards were chosen to guard the boilers in the main power plant . . . chosen by engineers trained in modern industrial research . . . chosen to insure the uninterrupted research which guards our nation's security.

Fireye Flame Failure Safeguards have set new standards of safety for industrial gas and oil burning boilers. Get the whole story. Write today for Bulletin 604-E.

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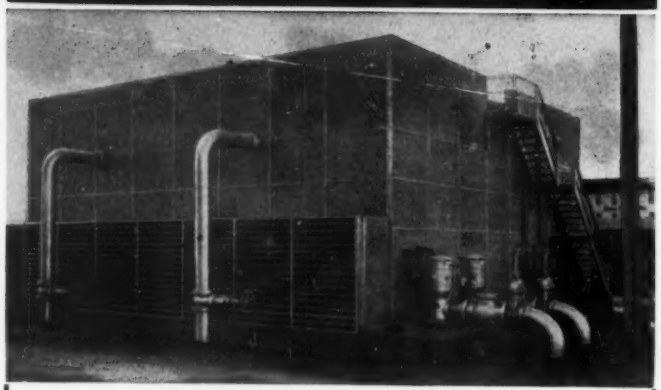
UNITED
COOLING TOWERS



8000 G.P.M. United power plant installation. Transite sheathed, deck tilled, low pressure distribution, two double induced draft cells.

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POWER . . . OIL . . . GAS AND REFRIGERATION

Individually Designed and Constructed in All Mechanical Draft Types

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Properly sized to take care of all peak load requirements. Carefully engineered to meet individual cooling problems. Constructed of any specified and mutually acceptable quality materials.

Many United installations now in service. Full details, illustrations, etc., in Bulletin No. 50.

Write for it today.

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UNITED COOLING TOWER CO.

Authorized Representatives in Principal Cities

Porter Building Kansas City 2, Missouri

wood has become sales manager of Montreal Locomotive Works, Ltd., Alco's Canadian affiliate.

Fire Extinguisher Div, **Ansul Chemical Co** announces opening of a district office in Buffalo, N. Y. This territory, comprising the 17 western counties of New York State, had formerly been operated by Plant Equip Corp, an Ansul distributor. Leslie J Wiechers, assisted by Omar J Lane and Charles Howson, will head the Buffalo staff.

New executive officers for **D J Murray Co,** Wausau, Wis., are as follows: A W Plier, executive vice-president and general manager; D J Everest, vice-president; C L Durkee, director, vice-president and sales manager; W A Marquardt, secretary; P W Hoeper, assistant secretary; and Grover Keeth, assistant treasurer.

Dowell Inc, has changed its Philadelphia address to 1421 Chestnut St, Philadelphia 2.

Robert C Black joins **Dravo Corp,** Pittsburgh, as advertising manager of machinery div. Black formerly was on the staff of the vice-president of Westinghouse Elec Corp.

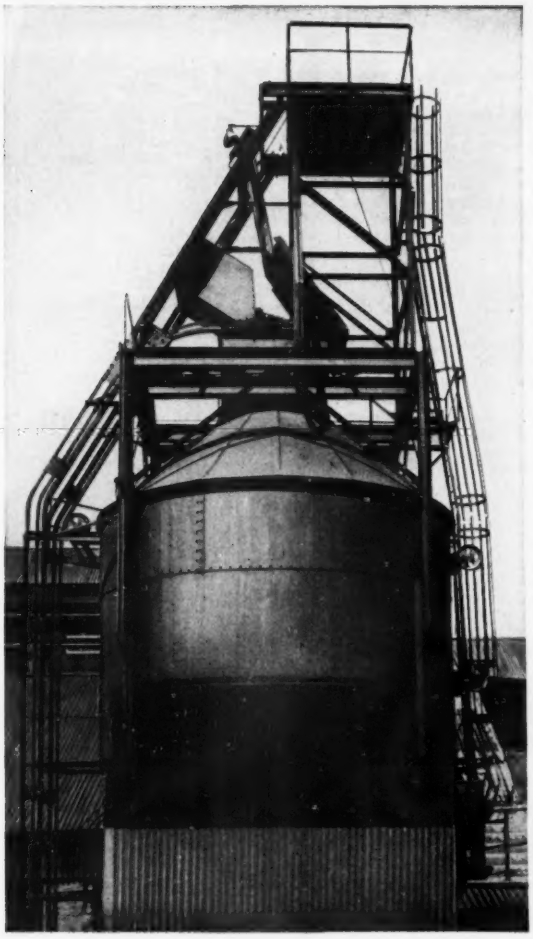
Tube Turns Inc selects Bethlehem Supply Co and Bethlehem Supply Co of California as distributors of Tube-Turn welding fittings and flanges. Bethlehem Supply Co with main offices in Tulsa, Okla., covers the territory of Arkansas, Colorado, Illinois, Kansas, Louisiana, Mississippi, New Mexico, Oklahoma, Texas and Wyoming. Bethlehem Supply Co of California has its main offices in Los Angeles.

Baldwin Locomotive Works has recently acquired the assets and business of **Lima-Hamilton Corp** which, under the name of Baldwin-Lima-Hamilton Corp, will hereafter carry on all activities formerly conducted by both companies. William Wood Prince has been elected a member of the executive committee. George H Lynn has been appointed general sales manager of Hamilton Div, with offices in Hamilton, Ohio. John D Dickinson has been made assistant district manager of New York office of the new corporation.

William G Mahlman is promoted to sales office manager of **Edward Valves Inc,** East Chicago, Ind. He succeeds Herbert J Rowe, who has been called back to the U. S. Marine Corps.

To fill the vacancy left by the sudden passing of Harry V Snyder, Manhattan's factory manager, the following appointments for **Manhattan Rubber Div,** Raybestos-Manhattan Inc, Passaic, N. J., have been announced: R J Gorecki, factory manager; W E Perkins, assistant factory manager; D J Fenelon, director of labor relations; R Griffith, personnel manager; J Freeland, manager, cord belt dept; A P Schneider, superintendent, cord belt dept.

Flexitallic Gasket Co reports the addition of the following distributors and agents to its field organization: Tate Engrg & Supply Co, Baltimore, distributor, will serve Maryland and Washington, D. C.; A L Crump & Co, Chicago, distributor, will



LOW COST DEPENDABLE COAL HANDLING FOR PUBLIC UTILITIES

Salem Gas and Light Company, Salem, Mass., found a G-W Skip Hoist the ideal solution to the problem of conveying coal and coke to producer storage. The skip bucket keeps the producer-storage bin filled at all times . . . and does the job with maximum economy.

Gifford-Wood Skip Hoists . . . one of many G-W systems of materials handling . . . are low in initial cost . . . low in maintenance . . . long-lived . . . completely dependable. Public utility companies the country over are becoming increasingly interested in Skip Hoist handling of coke, coal and ashes where space is limited and both initial and operating costs must be kept at rock bottom.

This particular installation may not be the perfect solution to your own particular problem. Gifford-Wood, however, has specialized in the design, engineering and installation of all types of materials handling systems for 136 years. To have a Gifford-Wood Materials Handling Engineer survey your present method of moving materials, places you under no obligation and it may well be your first step toward lower operating costs and increased production.

GIFFORD-WOOD CO.

Since 1814
HUDSON, NEW YORK

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When You Think of Materials Handling — Think of Gifford-Wood

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AUTOMATIC CONTROLS FOR INDUSTRIAL APPLICATIONS REQUIRING POSITIVE CONTROL OF PRESSURE, TEMPERATURE, LIQUID LEVEL ETC.

SIMPLE TO ADJUST FOR THE SPECIFIED OPERATING RANGE

MERCOID CONTROLS ARE EQUIPPED WITH MERCURY SWITCHES, THEREBY INSURING GREATER SAFETY, BETTER PERFORMANCE AND LONGER CONTROL LIFE

WRITE FOR CATALOG 600-B.

THE MERCOID CORPORATION
4201 BELMONT AVE. CHICAGO 41, ILL.

LOCKED IN STRENGTH of Tri-Lok open steel flooring gives efficient load distribution, even on long spans. Get maximum strength, light, and air with minimum weight. Available in Rectangular, Diagonal, and Super-Safety U-type Flooring, and Stair Treads of all kinds.

The Tri-Lok Company is also equipped to furnish *riveted* and Tri-Forge *welded* open steel flooring. Tri-Lok grating can be furnished in a variety of metals, including aluminum alloy, stainless steel, etc. Write for Bulletin MW1140.

DRAVO CORPORATION

National Distributor for the Tri-Lok Company

Dravo Bldg., Pittsburgh 22, Pa.

Sales Representatives in Principal Cities

DRAVO

serve northern Indiana and Illinois; Carl Grimes & Co, Des Moines, agent for western Iowa; Frank Valetti & Co will serve marine industry within the limits of Philadelphia; Southern Marine & Supply Co will serve marine industry within the limits of Savannah, Ga. In addition, Transmission Engrg Co, San Francisco distributor is expanding its service to include the marine industry in that area; and Eagle Asbestos & Packing Co, New Orleans distributor will now serve both industrial and marine industries in eastern Louisiana and southern Mississippi.

L A Keeler, vice-president, director and comptroller of **Fairbanks, Morse & Co,** Chicago, retired at the end of 1950 after 39 years of service with the company. Also, C G Gehringer has been promoted to manager of branch office in Louisville, Ky.

W E Henges is now vice-president of **Graybar Electric Co,** New York City. He will continue in capacity of assistant to the president. John T Porter is transferred to Rochester, N. Y., as branch house manager. Frank C Sweeney succeeds Porter as manager at Albany, N. Y.

Ladish Co has established a branch office at 405-406 Thompson Bldg in Tulsa, Okla. G E Mahoney is district manager of the new office. W H Heckenberg becomes district manager of St. Louis office which is now located at 3615 Olive St.

William S Lowe succeeds Robert S Green, resigned, as president of **A P Green Fire Brick Co,** Mexico, Mo. Green will continue as a member of the board of directors.

John W Pennington, former staff engineer for Caterpillar Tractor Co, has been named chief engineer of Piston Ring Dept, **Koppers Co,** Baltimore, Md.

Roots-Connersville Blower Corp appoints Koerner Engrg & Supply Co, Portland, Ore., as exclusive sales agents for all R-C products in the states of Oregon and Washington.

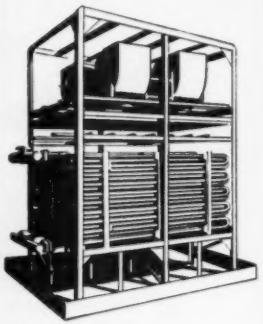
Sales offices and warehousing facilities of **B F Goodrich Co's** San Francisco district have been expanded into a new location at 1950 Army St.

Edward J Hanley succeeds E B Cleborne, resigned, as president of **Allegheny Ludlum Steel Corp,** Pittsburgh. Clark W King becomes executive vice-president, retaining his position as treasurer. In addition, W B Pierce assumes duties of technical director replacing Frank B Lonsberry, who resigned.

Airtemp Div, Chrysler Corp, has made Alvin J Schiffman manager of its Chicago region, and Stuart V Borthwick district representative for Cleveland region.

Appointment of H H Kumler Co, Houston and Tulsa, as representative in the states of Texas and Oklahoma, is announced by **American Flexible Coupling Co.**

Thermal Industrial Engrg Co, Denver, Colo., will represent the **Johnson Corp**



How to Improve Operating Efficiency of Evaporative Condensers

SOONER or later make-up water, used in evaporative coolers and condensers, becomes slime laden. Quick remedy is needed here to maintain trouble-free operation of air conditioning equipment. A most effective way to fight slime and side-step trouble is water-treatment with OAKITE SANITIZER No. 1.

This new, germicidal agent of the quaternary ammonium type destroys bacterial organisms and discourages slime growth.

FREE: Handy 20-page Guide contains many practical suggestions on low-cost maintenance of air conditioning and refrigerating equipment. Send for Booklet No. F 7383. No obligation.

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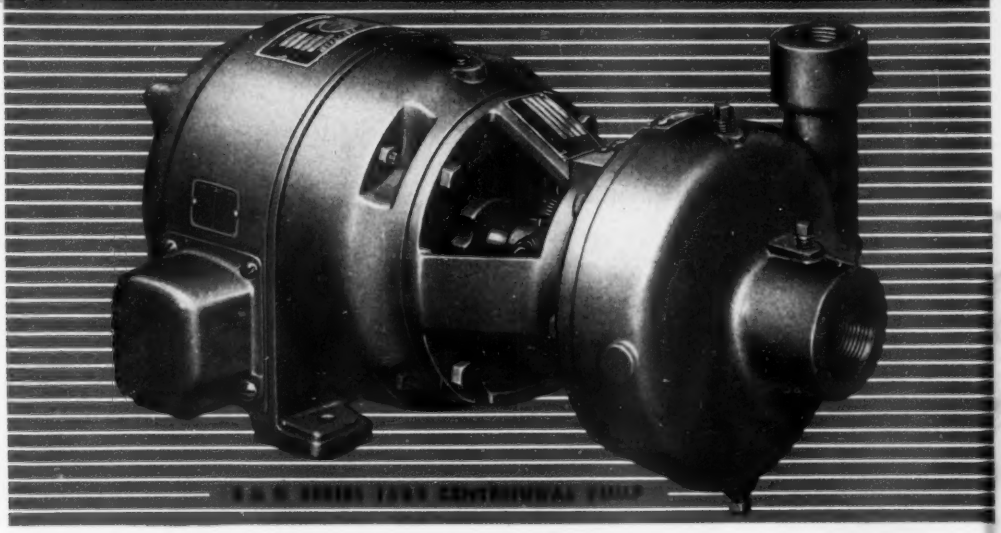
SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE

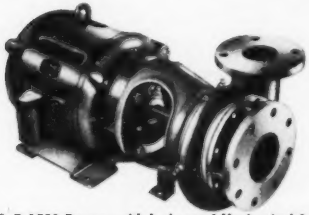
Technical Service Representatives Located in Principal Cities of United States and Canada

1...2...3...4...5...6...7...8 Big Reasons

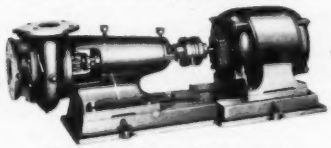
WHY THE B & G 1522 PUMP SHOULD BE YOUR CHOICE FOR TOUGH PUMPING JOBS



MORE PUMP VALUE PER DOLLAR



B & G 1531 Pump—with leak-proof Mechanical Seal



B & G 1510-15 Pump—flexible coupled

Engineers and maintenance men are astonished at the performance of the B & G 1522 Pump . . . because this unit licks the pumping jobs which usually cause trouble. For these reasons—

First: Leak-proof Mechanical Seal—ends stuffing box troubles.

Second: Spring-type flexible coupling—contributes to unusually quiet operation.

Third: Hydraulically balanced impeller.

Fourth: Easily serviced. Removal of a few bolts permits separation into three parts.

Fifth: Interchangeable parts. The bearing bracket subassembly, including shaft and sleeve bearings, is manufactured to close tolerances and is interchangeable in all 1522 Pumps.

Sixth: Shaft alignment maintained by oil lubricated, high grade bronze sleeve bearings.

Seventh: Standard motors—easily obtainable from motor manufacturer's stocks.

Eighth: With all these features B & G 1522 Pumps are *competitively priced!*

Send for Catalog CY-350

B & G

Hydro-Flo® PRODUCTS

Heat Exchangers . . . Water Heaters . . . Pumps . . .
Refrigeration Equipment . . . Forced Hot Water Heating Systems

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• DIRECT HEATING OF VAPORS

• DIRECT HEATING OF LIQUIDS

If your plant requires

• DOWTHERM INDIRECT HEATING

• STEAM GENERATORS

• STEAM SUPERHEATERS

• WASTE HEAT BOILERS

. . . place the selection of the specific type in specialized hands . . . and obtain optimum efficiency.

Petro-Chem Development Company engineers are heating specialists . . . they can supply the whys and wherefores of indirect versus direct heating and the economics of both.

Every day more than 750, oil and gas fired, Petro-Chem Iso-Flow installations in the petroleum, chemical and allied industries, demonstrate the efficiency of their design and installation.

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120 East 41st Street, New York 17, N. Y.

Representatives:

Bethlehem Supply, Tulsa and Houston • Flagg, Brackett & Durgin, Boston • D. D. Foster, Pittsburgh Faville-Levally, Chicago • Lester Oberholtz, Calif.

in Colorado, Montana, eastern Wyoming, western Nebraska, western Kansas and northern New Mexico.

James William Brooks assumes sales and engineering responsibilities for **Lincoln Electric Co** in Indianapolis district. Thomas L Dempsey is added to the staff of Cleveland sales organization as a special field engineer. Also, John F Kotchian is now in the firm's Chicago district.

Laclede-Christy Co selects C A Gordon as a representative in Buffalo, N. Y. He will have offices at 930 Prudential Bldg, Buffalo.

H K Porter Co, Pittsburgh, has acquired the **Delta Star Electric Co** of Chicago, manufacturers of high voltage electrical equipment. No change in operations or management of Delta Star is contemplated.

Hose Accessories Co appoints Arthur W Gadd, 1805 Grand Ave, Kansas City, Mo., as manufacturers' representative for states of Missouri, Kansas, southern Illinois, western Iowa and Nebraska. Also, Almon O Snyder, 8001 Carnegie Ave, Cleveland, will be the firm's factory representative in Ohio, Pennsylvania, West Virginia, Kentucky and southern Indiana.

Central Station Engrg Co, Tucson, has been named Arizona representative for **I-T-E Circuit Breaker Co,** and its subsidiary, Railway & Industrial Engrg Co. Clyde F Lewis is general manager of the representative firm.

Reliance Electric & Engrg Co announces several personnel and district office changes as follows: C B Allen becomes district manager in Buffalo, heading up the work formerly handled from Syracuse by G E Bevis. Allen is succeeded in Detroit by W C McConnell. Bevis is now a vice-president of recently acquired Canadian div of Reliance at Welland, Ont. McConnell, in turn, is replaced in Charleston, W. Va., by C V Harp Jr. William H Brehmer moves to Syracuse to head branch operations there. Elwood H Koontz becomes branch manager, and F R Obenchain joins him as sales engineer, of new branch office at 1060 Broad St, Newark, N. J. R C Suttle is made manager of new office at 202 Washington Ave, El Dorado, Ark. R I Coryell Jr replaces Suttle as sales engineer in Cincinnati.

Livingston Engrg Co has chosen John Baizley Co, 1325 Widener Bldg, Philadelphia, as district sales representative in southeastern Pennsylvania, southern New Jersey, northern Delaware and northern Maryland.

Norman W James, general purchasing agent of **Pennsylvania Salt Mfg Co,** Philadelphia, has withdrawn from active service with the firm, but will continue as a consultant and advisor on procurement problems as they may arise. Frederick G Prince has succeeded him.

Champlain Co, has acquired the business of **Pickering Governor Co** from Hart-

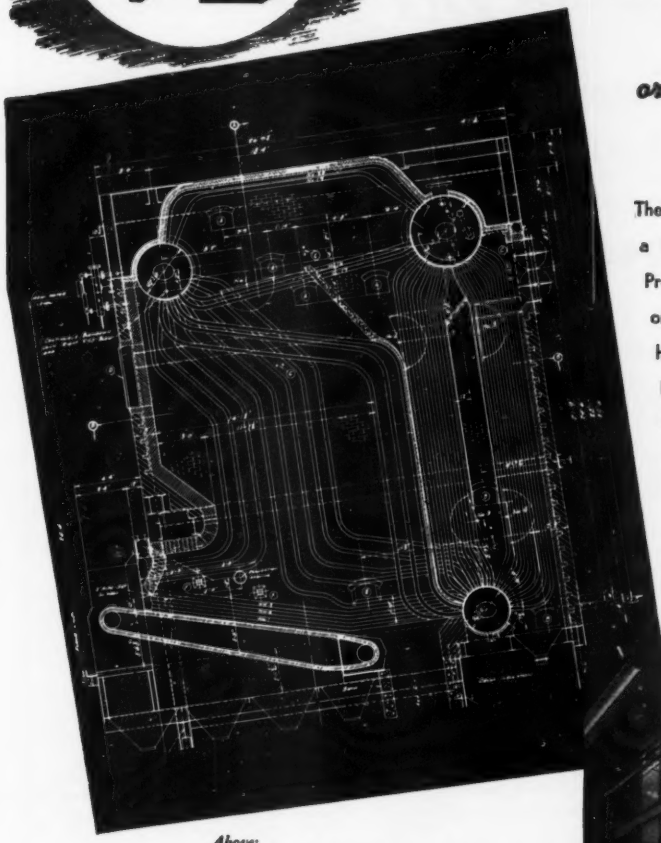
CLASS **VL**

Vogt

Steam Generating Units

for POWER *or* PROCESSING LOADS, *and* HEATING

The design provides large furnace volume and a high ratio of radiant heating surface. Proper combustion is assured with any fuel or method of firing. Superheaters, air preheaters, economizers, water walls, and soot blowers can be readily incorporated. Vogt Class VL Steam generating units are giving satisfactory service in Hotels, Sugar Refineries, Steel Mills, Furniture Factories, Distilleries, Oil Refineries, and related industries. A bulletin showing typical installations will be sent upon request.

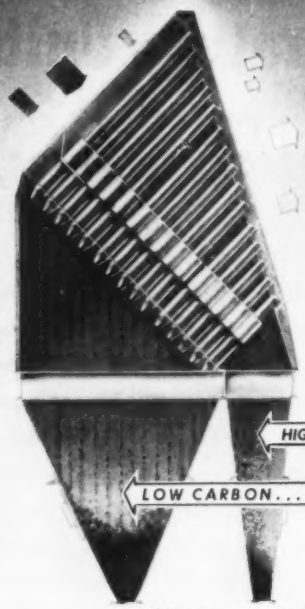


Above:
This 90,000 lbs. steam per hour unit, designed for 475 lbs. pressure, serves the Mansfield Tire & Rubber Co., Mansfield, Ohio.

Right:
Two 515 H.P. units installed in Brown-Forman Distillers Corporation, Louisville, Ky. Plant.

HENRY VOGT MACHINE CO. • 1000 W. Ormsby St., Louisville 10, Ky.
Branch Offices: New York, Philadelphia, Cleveland, Chicago, St. Louis, Dallas

REFIRE HIGH CARBON DUST *without* recirculating fly-ash

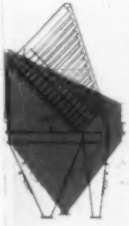


. . . install **pd**

TUBULAR DUST COLLECTORS *arranged for* DECANTATION

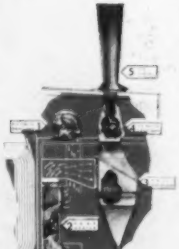
In a single phase P-D tubular collector, designed for decantation and *requiring no additional pressure drop*, it is now possible to separate the large particles of high carbon content from the non-combustible finer particles.

Fly-ash from spreader stoker-fired units, consisting of up to 40% high carbon particles, can effect considerable savings when re-injected. It is necessary to effect separation, however, since the non-combustible smaller particles remaining in the system increase in concentration, causing erosion and possible poor combustion due to spotting.



Space requirements for the decantation design are not as great in area and only slightly higher than a standard tubular . . . and, collection efficiency is high. Superimposed sketch shows comparative size.

Why waste fuel? Investigate this collector today, it will soon pay for itself. Write our Sales and Project Engineers for Bulletin 260 D.



UNIT RESPONSIBILITY

Prat-Daniel, through its sales and project engineers, The Thermix Corp., offer a complete complement for handling the air gas stream: Forced Draft Fans, Air Pre-heaters, Tubular Dust Collectors, Induced Draft Fans and Fan Stacks. This unit responsibility, by a well known firm, relieves the engineer of the responsibility for one of the most important functions in a steam generating plant.

Sales and Project Engineers

THE THERMIX CORPORATION
GREENWICH, CONN.

Canadian Affiliates: T. C. CHOWN, LTD.
1440 St. Catherine St. W., Montreal 25, Quebec
50 Abell St., Toronto 3, Ontario

Designers and Manufacturers

PRAT-DANIEL CORPORATION
EAST PORT CHESTER, CONN

ford Empire Co, Hartford, Conn. Under the new management, manufacture, sales, and service operations have been moved to Champlain's plant, 88 Llewellyn Ave, Bloomfield, N. J., where all operations will be continued. A number of the key personnel of the Pickering Governor Co have been retained, among them Charles B Taylor, chief engineer.

Rockbestos Products Corp, New Haven, Conn., names Charles A Berlepsch director of purchases, and Raymond B Miniter purchasing agent.

Wilbur E Combs is now product manager for **L H Gilmer Div,** U. S. Rubber Co. He will make his headquarters at the Gilmer plant in Tacony, Philadelphia, Pa.

Charles L Foss has joined the staff of **U. S. Air Conditioning Corp** as assistant to A A Feinberg, president.

Evan Price assumes duties of turbine sales manager for **Whiton Machine Co,** New London, Conn.

Carl H Krause has purchased **Blue Seal Asbestos Co,** Brooklyn, N. Y., and will function as its president. He had formerly been New York works manager for Trumbull Electric Mfg Co.

Stanley Stokes, chief engineer, and George P Gamble, superintendent of power, of **Union Electric Co** of Missouri, have been elected vice-presidents.

New York State Electric & Gas Corp names J. Riley Stover to succeed William W Perry, retired, as chief electrical engineer. George E Dana becomes assistant chief electrical engineer.

Abitibi Power & Paper Co, Ltd, Toronto, Ont., has elected W H Smith executive vice-president of the company, C B Davis, vice-president (woodlands) and R J Askin, vice-president (manufacturing).

Warren C Drummond, chief engineer of **Pioneer Service & Engrg Co,** Chicago, is now a vice-president of the firm.

Dr Charles Beckett joins the staff of Thermodynamics Section of **National Bureau of Standards** where he will be active in preparation of tables of thermal properties of gases.

Diesel Engine Mfrs Assn has elected the following officers for the ensuing year: *President* — Otto H Fischer, president, Union Diesel Engine Co, Oakland, Calif.; *vice-president*—A W McKinney, executive vice-president, National Supply Co, Toledo; *vice-president*—Marvin W Smith, president, Baldwin-Lima-Hamilton Corp, Philadelphia; *treasurer*—Robert H Morse Jr, president, Fairbanks, Morse & Co, Chicago.

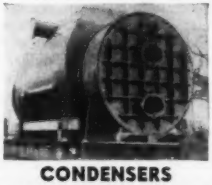
Ward Leonard Electric Co, Mount Vernon, N. Y., has established an Industrial Chrome Div for chrome plating of machine-tool accessories and component parts, with W G Dawson as manager. Exclusive license for manufacture and sale has been obtained from Chromecraft Corp.

BOILERS

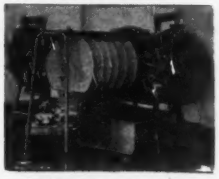
DEAERATORS

EVAPORATORS

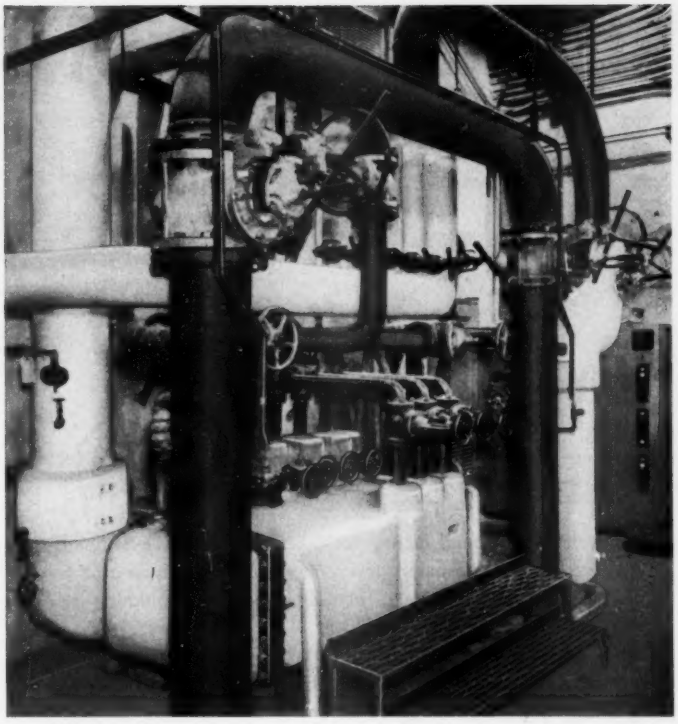
CLOSED HEATERS



CONDENSERS



REFINER FILTERS



Three TRIPLE ELEMENT TWO-STAGE

CONSECO

STEAM JET AIR EJECTORS

These Conseco Air Ejectors constitute part of units No. 3, 4 and 5 which are installed in the Harbor Steam Plant, Los Angeles, California. Each ejector operates with steam at 400 psig, 850° FTT and serves a twin 70,000 sq. ft. Conesco Condenser handling a 75,000 K.W. turbine.

CONSECO service is available for designing, manufacturing and installing Steam Jet Air Ejectors for all requirements of the power, chemical and process industries. Write for a copy of our new Engineering Bulletin #103, describing CONSECO EJECTORS in detail and giving valuable technical information.

CONSECO

Condenser Service & Engineering Co.

HOBOKEN, N.J.

BUY REGULATION

BUY FOSTER

WHEN you spend money for a reducing valve, a temperature regulator, a pump governor, or any other type of automatic valve, what you're actually buying is *regulation*—not just a valve.

Today it is important to pick the *right* valve the *first* time. Because, with the increased demand for all types of equipment, you may not get a *second* chance.

It should be *right* 3 ways: 1) . . . to give you the regulation you need. 2) . . . to give you years of service. 3) . . . to require the least down-time for repairs.

Foster Valves meet the requirements:

1) . . . There's a type and size of Foster Automatic Valve for every service requirement, so that you can get the regulation you need without makeshifts.

2) . . . For more than 70 years Foster has been building valves that stand up. Many have been in constant service for thirty years and more.

3) . . . Foster Valves are designed so that when normal inspection and overhauls are required, accessibility makes the job quick and easy.

Foster Engineers are qualified and ready to help you get the right valve.

Buy Foster

SEE OUR CATALOG IN SWEET'S

FOSTER ENGINEERING Company

835 Lehigh Avenue • Union, N. J.

OBITUARIES

Edward W Adams, 42, assistant engineer at the power plant of Boston Naval Shipyard, died Dec 10 after a short illness.

G A Daeuble Jr, 60, vice-president and manager of valve and fittings sales, Henry Vogt Machine Co, Louisville, Ky., died suddenly Nov 26.

Arthur W Dale, 53, general manager of sales of Mining Div, Gardner-Denver Co, died suddenly Dec 18 in his office at the company's plant in Quincy, Ill.

Byron C Ford, 52, chief operating engineer, U. S. Custom House and Appraisers' Stores, Boston, Mass., died suddenly Dec. 13.

Harry V Snyder, 56, factory manager, Manhattan Rubber Div, Raybestos-Manhattan Inc, Passaic, N. J., died suddenly Dec 2 at Point Pleasant Hospital, Point Pleasant, N. J.

Reclamation Project Gets 22,500-Hp Pumps

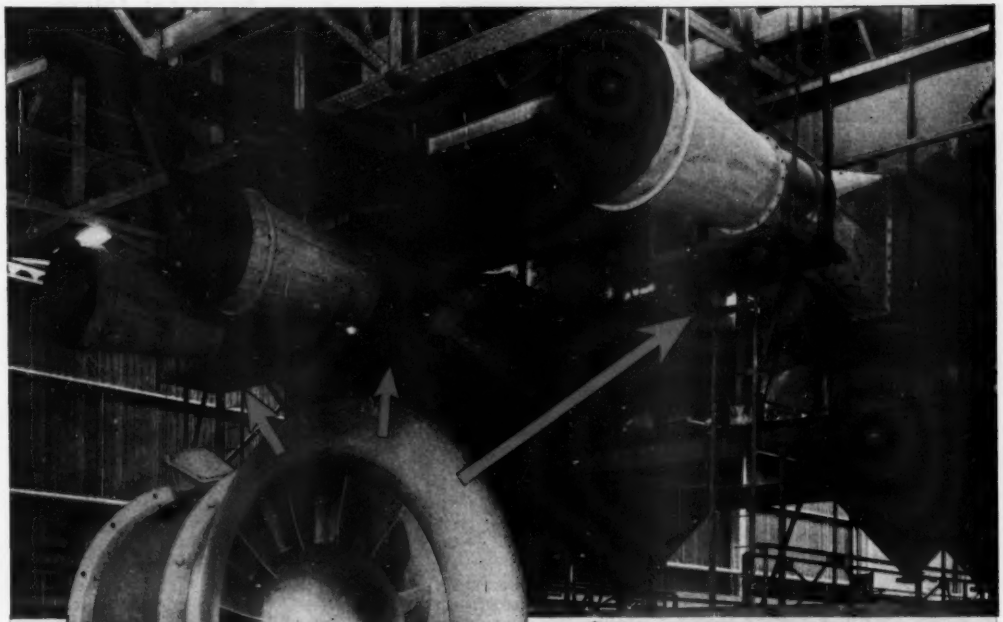
The sixth 22,500-hp Worthington centrifugal pump has been delivered to the U. S. Bureau of Reclamation project at Tracy, Calif., to complete that company's contract. The pump contract was awarded in June 1946 and shipments started in Sept 1949. The pumps lift water from the Sacramento River, into the 120-mile Delta Mendota Canal to irrigate farms in the San Joaquin Valley. Each pump is rated at 767 cu ft per sec (345,000 gpm) at 200-ft head.

The completed plant will pump nearly 3 billion gallons per day. In 30 min the six pumps driven by 135,000 hp of motors can handle more water than the city of Sacramento consumes in an average day. To house these pumps, the world's second largest pumping plant was built at Tracy in an excavation larger than Boulder Dam. The project was started in October 1947 and it is expected to begin operation early in 1951.

Thomas A Marsh, national industrial engineer for **Iron Fireman Mfg Co,** has been awarded the grade of Fellow in the American Society of Mechanical Engineers. The honor was bestowed by the Joint Fuels Conference of the Fuels Div of ASME and the Coal Div of the American Institute of Mining and Metallurgical Engineers.

James P Marsh Corp put into service in January a large addition to its Skokie, Ill., plant. The addition measures 225 by 75 ft, and increases manufacturing space by about 17,000 sq ft.

The James Clayton lecture, at the general meeting of the automobile div, Institution of Mechanical Engineers, London, England last November, was given by **C G A Rosen,** former director of research at Caterpillar Tractor Co and now a consulting engineer. Rosen is the sixth man so awarded the James Clayton lecture honor and the second American.



What's your ventilation job?

JOY AXIVANE* FANS

WILL DO IT MORE EFFICIENTLY AND MORE ECONOMICALLY!

Write for Bulletin, or *Consult a Joy Engineer*

From every possible angle, JOY Series 1000 AXIVANE Fans will give you a better, lower-cost job. Their inline, vane-axial design is lighter and more compact; and they operate more quietly, require less power and space, and save greatly on installation time and costs. What's more, you get the extra flexibility of adjustable blades—a standard JOY feature—permitting easy and quick on-the-job regulation of pressure or volume over a wide operating range, with positive protection against motor over-load. ● Whatever your job is, JOY AXIVANE Fans can show you advantages—let us work with you.

*Reg. U.S. Pat. Off.

WBD 12356

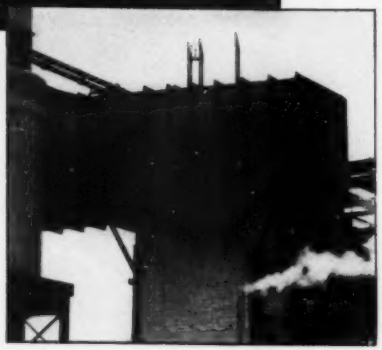
JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

For HIGH Quality, **LOW** Cost

Ask Littleford about Breechings and Ducts



They all look alike to Littleford . . . big jobs and little jobs, in any shape and in any weight of metal. Highly skilled craftsmen get the utmost out of modern facilities for shearing, punching, bending, rolling and welding. Give that next job of yours the benefit of Littleford's 68 years of engineering all kinds of powerhouse fabrications . . . send your blueprints for our quotation.

FABRICATORS OF PLATE AND SHEET METALS

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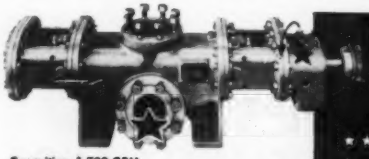
LITTLEFORD BROS., INC.
438 E. Pearl St., Cincinnati 2, Ohio

DUCT WORK—BREECHINGS
ELECTRICAL ENCLOSURES—STACKS
TRANSFORMER HOUSINGS—TANKS
CONTROL DESKS—INSTRUMENT PANELS
CUBICLES—PIPING—CABLE PANS

NEW Sier-Bath SCREW PUMP
for NON-LUBRICATING LIQUIDS



External Gear & Bearing Bracket Type with *New*
★★ "Dual-controlled" ROTORS
★ Single-point ALIGNMENT

Capacities: 1-700 GPM
Discharge: 1000 PSI for viscous liquids
250 PSI for water

USED to move your non-lubricating fluids or semi-fluids, this powerful new screw pump will give you greater dependability, longer life, and cost you less to service and maintain. For less wear on bearings and timing gears, its rotors are "dual-controlled"—*axially* by heavy-duty thrust bearings, and *radially* by precision cut timing gears and heavy duty roller bearings.

To eliminate the possibility of bearing strain and rotor misalignment, the gear and bearing housings now form an integral unit with the pump body. Thus they move *with* the pump body if it is slightly displaced during installation, or if it expands when handling hot liquids.

Servicing is speeded by the new bracket arrangement. The rotor shafts are clearly marked for accurate positioning of parts, and all parts are automatically positioned by shoulders and locknuts.

Direct-connected up to 1800 RPM. Available in horizontal or vertical construction, corrosion resistant alloys. Special bodies, stuffing boxes and bearings for high temperature applications.

WRITE FOR FURTHER INFORMATION

9254 HUDSON BLVD.
N. BERGEN, N. J.

Sier-Bath GEAR and PUMP CO., Inc.

Founded 1905 Members A.G.M.A.

TECHNICAL BRIEFS

USE OF THE JET MILL FOR COMBUSTION PURPOSES AND FOR THE FINE GRINDING OF VARIOUS MATERIALS, *by G M Croft, Blaw-Knox Co, Pittsburgh, Pa.* Describes the application of the fluid-energy pulverizer to industrial uses. These applications will apply in general to solid-fuel combustion and grinding of various materials including chemicals, insecticides, pigments, foods, building materials, etc.

The fluid-energy pulverizer by its inherent design uses energy for pulverization from superheated steam or air and from compressed air at atmospheric temperature where necessary because of temperature-control conditions. Particle-size reduction of the product is obtained by high-velocity impingement of particle against particle. This method of pulverization provides a mill that is comparatively low in maintenance because the materials being pulverized are ground against themselves rather than any portion of the mill.

The fluid-energy pulverizer in the combustion field can be used for pulverizing any grade of solid fuel regardless of moisture content and grindability factor. Such fuels include anthracite, bituminous coal (both high and low grades), coke breeze, petroleum coke, lignite, etc. This mill is capable of pulverizing fuels to a fineness considerably in excess of conventional practice and at a lower cost for equivalent pulverization than other mill types.

The mill is especially applicable to the fine grinding of materials other than solid fuels. A power-driven classifier affords precise control in micron sizes, particularly top particle sizes. Other adjustments in the mill are effective for control of average micron-particle sizes. The low maintenance of the mill on abrasive materials results in minimum contamination of finished product because of negligible wear of the mill. *AISE paper. No number. Iron and Steel Engineer, Pittsburgh, Pa.*

For more briefs, see page 128.

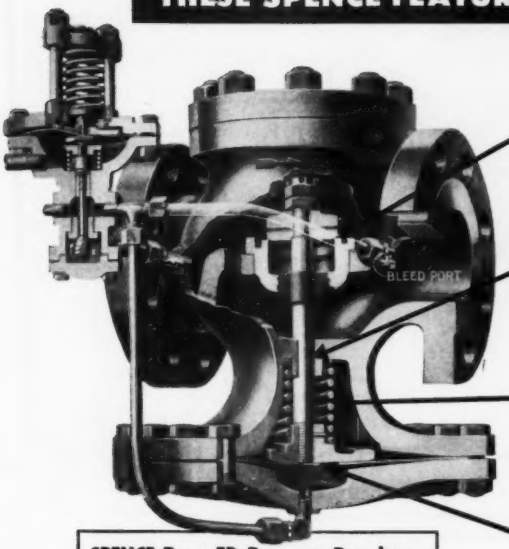
DeLaval Steam Turbine Co has initiated the use of nodular iron for pump castings. They have reported entirely satisfactory hydrostatic tests on such units with a slight deflection at 750 psi and no leakage at 1500. Some foundries have been licensed to make the nodular iron. One is the Farrel-Birmingham Co, Inc of Ansonia, Conn.

Dusseldorf, Germany: A new type boiler furnace installation has been put in use at the German shaft plant **Minister Stein** in Dortmund. It employs a pumping device built into the furnace grate, which is said to effect more even fuel distribution, higher furnace heats, less combustible in the slagged flyash.

HERE'S PROOF

You Can Cut Costs of Pressure and Temperature Control

THESE SPENCE FEATURES SHOW YOU HOW



SPENCE Type ED Pressure Regulator

SECO METAL SEATS AND DISCS — Durable SECO Metal resists wiredrawing. *More than twenty years of experience* in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

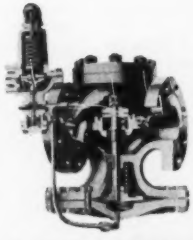
SPRING OUT OF PATH OF STEAM — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

LARGE BALANCED DIAPHRAGM—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.

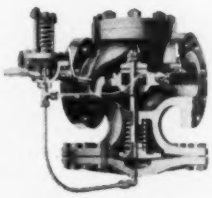
YOU BENEFIT by these and many other Spence features that assure *accurate, dependable* regulation year after year. That means *less down-time, less time and money wasted on replacement of parts.*

Spence Pressure and Temperature Regulators are built in sizes from *¼" to 12"* for service with *air, steam, water, oil or gas.* Only minor adjustments are needed to switch any Spence Regulator from one service to another.

Type ET150 Temperature Regulator—Tops in performance for both storage and instantaneous heaters.



Type EN Differential Regulator—Accurately controls differential between fluid delivered by regulator and some other source of pressure connected to the pilot spring chamber.



Type EQ Back Pressure Regulator — Completely packless, pilot operated for accurate control of the initial pressure.

These Companies Have Profited with SPENCE!

The Springs Cotton Mills
Ford Motor Company
Pennsylvania Power & Light Company
Jones & Laughlin Steel Corporation
National Tube Company
The Atlantic Refining Company
Great Lakes Steel Corporation
Todd Shipyards Corporation
Land O'Lakes Creameries, Inc.
General Electric Company
R. J. Reynolds Tobacco Company
Ohio Edison Company

and thousands of others

SPENCE ENGINEERING COMPANY INC.
WALDEN, NEW YORK

Spence

GOOD QUALITY STEAM

even at concentrations above 15,000 parts per million!

You may find it hard to believe that good quality steam can be produced with boiler concentrations in excess of 15,000 parts per million. But look at this analysis of samples from a Southwestern refinery power plant.

HERE'S PROOF!

THE BIRD-ARCHER COMPANY
NEW YORK 17, N. Y.

PHILADELPHIA 40, PA.
LABORATORY AND PLANT
4317 NORTH AMERICAN STREET

GENERAL OFFICES
400 MADISON AVENUE

CHICAGO 11, ILL.
WRIGLEY BUILDING

Date: April 27, 1950

CHEMICAL ANALYSIS

Results expressed in [redacted] parts per million

SAMPLE MARKED	Boiler Make-Up (Raw)	Conden-sate	Boiler Feed	Boiler #5	Boiler #8		
ANALYSIS NUMBER 500410							
Total Dissolved Solids	1002	6	612	15980	13992		
Suspended Solids	Trace	0	8	1052	332		
Carbonate Hardness ($CaCO_3$)							
Non Carbonate Hardness ($CaCO_3$)							
Total Hardness ($CaCO_3$)	36	0	20	0	0		
Calcium ($CaCO_3$)	24						
Magnesium ($CaCO_3$)	12						
Sodium (Na)							
Silica (SiO_2)	13		7	88	88		
"P" Alkalinity ($CaCO_3$)	0	0	8	1520	1410		
"M" Alkalinity ($CaCO_3$)	168	4	112	2160	1910		
"OH" Alkalinity ($CaCO_3$)			0	1030	1020		
Chlorides (Cl)	420	0	256	5900	5240		
Sulfate (SO_4)	27	0	12	224	212		
Phosphate (PO_4)		0	0	60	55		
Nitrate (NO_3)							

Caustic embrittlement observations have been made at this plant for more than ten years with continual negative findings.

HOW? **with CONCENTROL**

Bird-Archer's new Concentrol was specially developed to eliminate foaming and boiler water carryover due to high alkalinity, dissolved solids, suspended solids or any combination of them.

Concentrol works by effecting a rapid change in surface tension of steam bubbles which permits coalescence of small steam bubbles into bubbles of larger size. This results in the formation of unstable bubble films which break readily upon reaching the steam disengaging surface of the boiler water, thus eliminating foam build-up and subsequent boiler water carryover.

Concentrol is available in several different formulations, some of which contain selected tannins, which condition boiler water sludge and suspended matter, maintaining them in a highly fluid, non-adherent form. Concentrol may be safely fed through feedlines and when fed continuously will help inhibit feedline deposits.

For full details on economical, efficient Concentrol, send for Data Sheet. For recommendations on your specific problem, consult your nearest Bird-Archer representative. Or, write direct to Bird-Archer outlining the details of your boiler operation.

BIRD-ARCHER

WATER TREATMENT

THE BIRD-ARCHER COMPANY, 400 MADISON AVE., NEW YORK 17, N. Y.

PHILADELPHIA • CHICAGO

IN CANADA: The Bird-Archer Co., Limited, 503 McGill Building, Montreal, Canada

IN MEXICO: Calderas y Accesorios, S. A., Amsterdam 291, Mexico, D. F.

LABORATORIES · ENGINEERS · CHEMISTS

BA-150

STRICTLY for the EXPERTS

If the ordinary "run-of-the-hill" skier tried this, about all he could expect would be an extra-size sitzmark in the snow. But for the ski-master, it's almost as easy as falling off a log. It's his business to know how to make the difficult look easy, and he has to spend many years to attain such proficiency.

Our present skill in the prefabrication and installation of high-pressure, high-temperature piping is the product of more than fifty years of hard work. During that time, we have provided this country's leading power and industrial plants with stainless, alloy, and carbon steel piping that reflects the highest standards of engineering and craftsmanship. Let us give you an estimate on your next installation.

REPRESENTATIVES IN BOSTON, NEW YORK, CLEVELAND, MOBILE AND HAVANA

WESTPORT JOINT

(PATENTED)

W. K. MITCHELL & CO., INC.

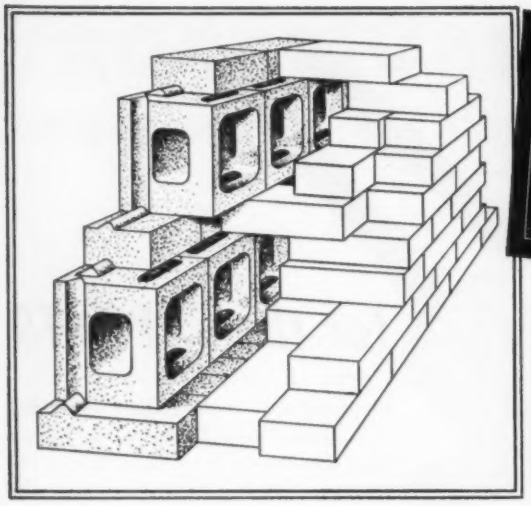
2944 ELLSWORTH STREET

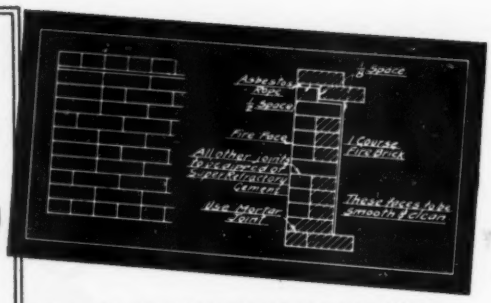
PHILADELPHIA 46, PA.

SINCE 1877

MITCHELL

PIPING FABRICATORS AND CONTRACTORS




Asbestos Rope
½ Space
Fire Face
All other joints to be coated with Super Refractory Cement
Use Mortar Joint
½ Space
1 Course Fire Brick
These faces to be smooth & clean

ILLUSTRATING CONSTRUCTION OF SOLID WALL with up to 9 courses of Norton Crystolon bricks laid with Norton Alundum cement. Such walls pay for themselves many times over because of freedom from clinker adherence and lower labor costs for cleaning.

AIR-COOLED WALLS of Norton Type A Crystolon* Hollow Blocks and Crystolon Bricks laid with Norton Alundum* cement far outlast fire-brick and other types of refractory walls. Norton Type B (T-shaped) and Type C (U-shaped) blocks and bricks are also available in Crystolon refractory for replacement purposes.

How to build EXTRA LIFE *into your boiler walls*

If fire-clay brick walls are causing you to shut down boilers frequently for repair of spalled, eroded or cracked refractories, it will pay you to switch to special refractories made of silicon carbide.

Many power plants report longer life and lower over-all costs from the use of Norton Crystolon silicon carbide refractories.

Air-Cooled Walls

Norton Crystolon hollow blocks and solid bricks with mating tongues and grooves have been designed to simplify the construction of air-cooled walls in boiler furnaces. While the unique design of these blocks makes a hit with masonry crews, it's the physical and chemical properties of Norton Crystolon refractory that really pay off.

Made of dense silicon carbide with a minimum of refractory bond, Norton Crystolon shapes are highly resistant to the four common causes of boiler wall failure. (1) Being highly refractory, they successfully resist temperatures up to 2900°F. (2) They're so dense that they effectively resist slag penetration. (3) Resistance to clinker adhesion is also high. However, if clinkers do adhere to a limited extent, their rugged strength permits removal without damage to the surface of brick or block. (4) Since silicon carbide is an extremely hard abrasive in its own right, Crystolon shapes are not noticeably affected by abrasion, even that caused by the moving fire bed of stoker-fired furnaces.

Solid Walls

The same advantages that make Crystolon hollow blocks such a good investment for air-cooled walls also apply to Crystolon bricks for solid walls. Their longer service and lower maintenance cost more than compensate for the cost differential between them and ordinary fire brick.

For best results, not less than five courses of Crystolon brick should be used in any boiler furnace. Only in the case of unusually thin fire beds or other exceptional operating conditions are fewer courses satisfactory.

Alundum Cement

Whether you decide on air-cooled or solid walls of Crystolon refractories, Norton RA-1019 cement is recommended for laying up the blocks or bricks. This cement is chemically stable and assures a very strong bond. Used as a slip for making dipped joints, this fine-grained aluminum oxide cement matures at 1850°F and withstands temperatures up to 3100°F.

Write for Bulletin 862

For more complete information about Crystolon shapes and Alundum cement, consult your nearby Norton representative, or write direct for Bulletin 862. NORTON COMPANY, 600 NEW LOND ST., WORCESTER 6, MASS.

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

NORTON

TRADE MARK REG. U. S. PAT. OFF.

Making better products to make other products better

Special REFRACTORIES

Canadian Representative

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General View of Bay Front Steam Plant
Lake Superior District Power Co.
Sargent and Lundy
Consulting Engineers

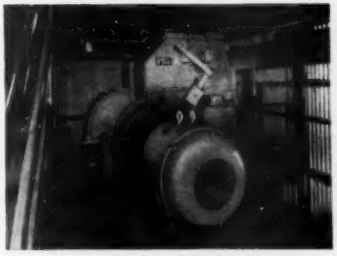
Bartlett-Snow coal handling at Ashland

● The illustration above shows the first 38,600 KW unit of a plant which is to be extended into a 60,200 KW station. Coal is received by lake boat at a near-by deep water dock, and carried to the plant in railroad cars. All handling facilities including the track hopper and grillage, duplex feeder, conveyors, gallery, chutes, tripper and all supporting structures, were fabricated in our shops and installed by our erectors to Sargent and Lundy specifications. For maximum efficiency and fixed unit responsibility, let the Bartlett-Snow coal handling engineers work with you on your next job.

DESIGNERS
ENGINEERS

BARTLETT-SNOW
CLEVELAND 5, OHIO

FABRICATORS
ERECTORS



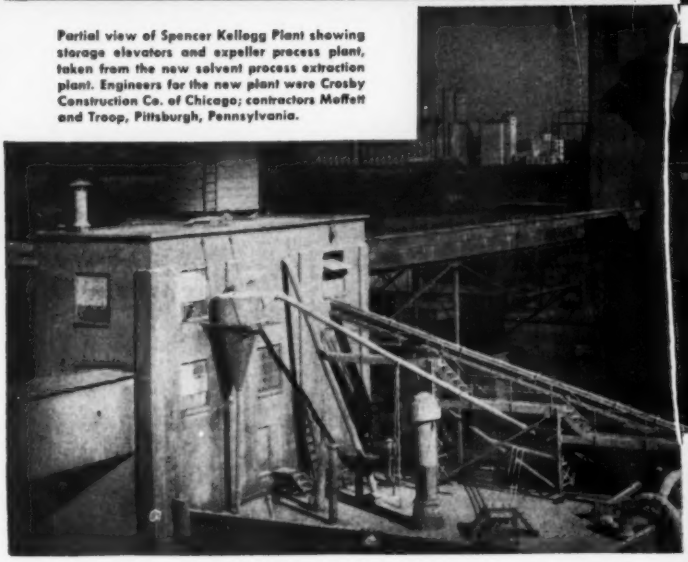
150 Ton Per Hour Ring Roll Crusher
Showing By-Pass Gate and Drive

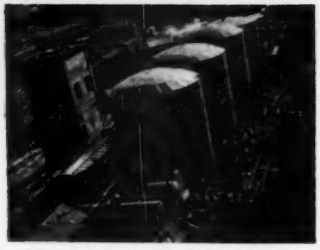
Belt Conveyor Showing Automatic
Weightometer and Vertical Take-up

Another RIC-WIL INSTALLATION FOR YEARS OF TROUBLE-FREE TOP PERFORMANCE

"On-the-job" stockpile of Ric-wiL Prefabricated Insulated Piping.

Partial view of Spencer Kellogg Plant showing storage elevators and expeller process plant, taken from the new solvent process extraction plant. Engineers for the new plant were Crosby Construction Co. of Chicago; contractors Moffett and Troop, Pittsburgh, Pennsylvania.





View showing oil tanks and pipe hanger supports for the new extraction plant.

RIC-WIL PREFABRICATED INSULATED PIPING SPEEDS UP INSTALLATION

The solvent extraction process used in the new Spencer Kellogg soy oil extraction plant at Decatur, Illinois, requires extensive piping systems for conveying cold and recirculated water, steam, condensate, soy oils, and solvents.

The use of Ric-wiL Prefabricated HEL-COR Piping for overhead lines speeded up installation and provided the system with maximum insulation and protection. Two 4-inch lines carrying soy oil and a steam tracer line for proper temperature control were nested in a solid insulation cylinder and housed in a 16-gauge ingot iron conduit, helically-corrugated and zinc galvanized. For additional corrosion resistance, outside of conduit was coated with high melting point asphalt and inside coated with baked-on phenolic resin.

All accessory piping units such as elbows, tees, and expansion loops were prefabricated by Ric-wiL, insuring simple, fast installation when they reached the job.

This installation is indicative of how Ric-wiL may solve your insulated piping problems. A Ric-wiL representative near you will give you complete information without cost or obligation, or if you prefer, write to The Ric-wiL Company, Dept. 7-TA, Cleveland, Ohio.

Crane assists in positioning Ric-wiL Piping in elevated installation.

40th YEAR DEPENDABLE INSULATED PIPING SYSTEMS RIC-WIL 1910-1950

RIC-WIL

INSULATED PIPING SYSTEMS

OVERHEAD — THE RIC-WIL COMPANY · CLEVELAND, O. — UNDERGROUND

FOR FORTY YEARS THE GREATEST NAME IN INSULATED PIPING SYSTEMS

You can't install a *better* valve than a POWELL VALVE —there IS no better!

Over a century of concentration on making one—and only one—kind of equipment must have a definite result. With Powell, the result is not only an amazingly complete* line of valves for industry but also the *best* valves it is possible to make.

*Powell Valves for Power Plants include not only a complete line of standard valves of all types but also many special designs to meet the latest requirements of modern power services.

Quality fine throughout "The Line"

Fig. 1793. A large 125-pound Iron Body, Bronze Mounted Gate Valve for low pressure steam, oil, water and gas services.

POWELL

The WM. POWELL CO., 2525 Spring Grove Ave., P. O. Box 106, Station B, Cincinnati 22, Ohio

Zallea Expansion Joint News

PUBLISHED BY ZALLEA BROTHERS—WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS EXCLUSIVELY

Expansion Joint of the Month

GAS TRANSPORTER USES ZALLEA

ZALLEA EXCLUSIVE FEATURES

Zallea Stainless Steel Expansion Joints have many features not found in competitive products. The control exercised in production and design, resulting from continuous research, accounts for their exceptionally long life. Designed with large radii at the root and crest of each corrugation, there are no sharp corners or circumferential welds to set up stress concentrations, which cause early failure. Hydraulically formed from cylinders having only longitudinal welds, the thickness of which is the same as the parent metal without grinding, they are subjected to internal forming pressures many times in excess of the design working pressure. After forming, the corrugated bellows is annealed in furnaces controlled by recording potentiometers. This is followed by pickling and passivating in controlled temperature acid baths to remove the scale formed during the annealing and to impart a corrosion resisting surface to the metal. Without proper pickling and passivation, the bellows would rust almost as rapidly as carbon steel in the average atmosphere. For longer service life . . . for the *best* in expansion joints, insist on Zallea . . . you'll find it pays!

The supply is going fast . . . send *TODAY* for your copy of Catalog 47, a text book and valuable reference source on all Zallea Expansion Joints.

Zallea Brothers, 814 Locust Street, Wilmington 99, Delaware.

Our Readers Ask

Q. *We installed (censored) expansion joints in our pipe lines. Two failed at the weld. What is being done industry-wise to overcome this condition? G. S. Thomas. Grand Rapids, Michigan.*

A. We here at Zallea have been well aware of this general condition for many years, Mr. Thomas. And we did something about it. Accelerated flexing tests of corrugated bellows proved that the resultant welding bead of a shielded arc weld was detrimental to the life of the bellows because failure always occurred across the weld—thickest section of the bellows. We found that by adopting an *exclusive* variation of the Heliarc process and adding a grain refining procedure to the finished weld, we could produce a corrugated bellows that under extreme flexing tests *failed in the parent metal only.* After hundreds of tests made with Zallea *controlled* welding, not one failure occurred within 30 degrees of the weld line. More important was the fact that these bel ows lasted our to eight times longer than bellows having a shielded arc welding bead.

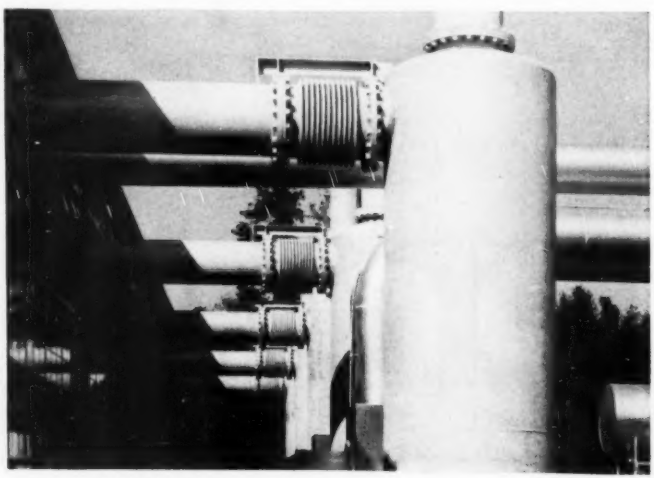
29 Flexible Connectors Installed on Diesel Exhaust Lines

Shown here are five 24" diameter Zallea Type 347 Stainless Steel Flexible Connectors installed on the Diesel exhaust lines at a compressor station along one of the nation's largest natural gas transmission lines. Five modern, well-equipped compressor stations in the system depend on 29 Zallea Stainless Steel Flexible Connectors for assurance of dependable performance and uninterrupted service.

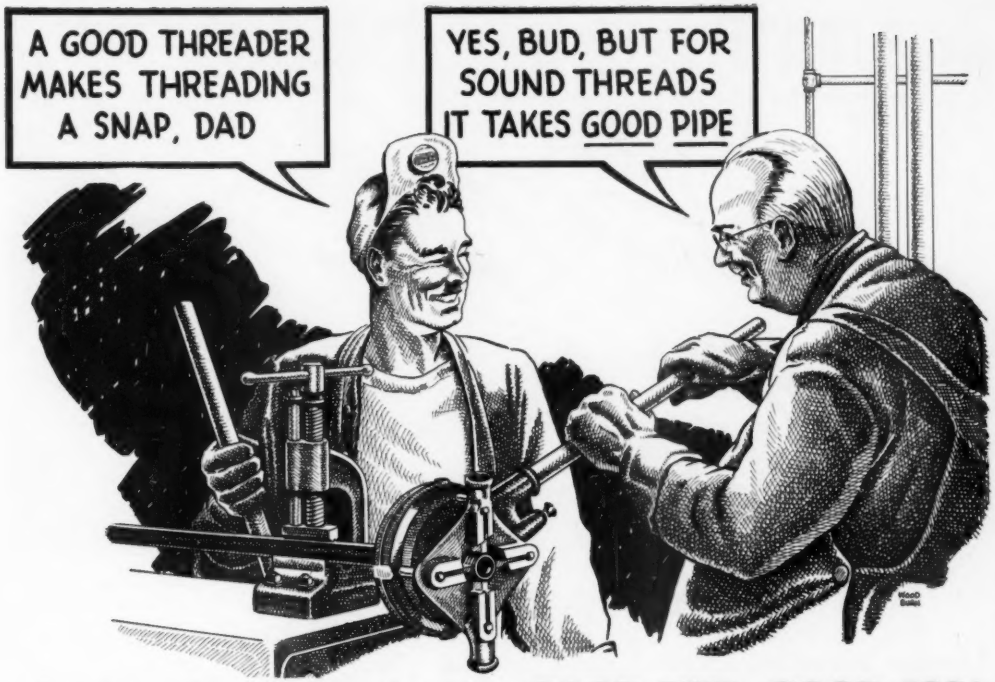
Absorb Lateral and Axial Movement

Here, as in thousands of installations throughout industry, Zallea Stainless Steel Flexible Connectors are built to absorb *both* lateral and axial movement. They are extremely flexible and long-lasting because of their design, having a true bellows form. Hydraulically formed and with uniform wall thickness, all corrugations are annular and parallel, with the axis perpendicular to the center-line of the connector.

All Zallea Stainless Steel Flexible Connectors are formed from tubes having a single longitudinal weld to provide for longer service life. They are permanently gas-tight and require no packing.



(Advertisement)



Good workmen + good tools + GOOD PIPE=GOOD JOB!

7 POINTS OF UNIFORM GOODNESS IN YOUNGSTOWN STEEL PIPE

- uniform ductility
- uniform lengths
- uniform threading
- uniform weldability
- uniform wall thickness and size
- uniform strength and toughness
- uniform roundness and straightness

WHEN your die is sharp and true, you enjoy cutting threads on Youngstown pipe. That's because it's so uniformly soft, so round and uniform in size. It has the toughness and strength, too, that make your threads full and well formed, clean and sharp. The name "Youngstown," rolled into every length, tells you it's GOOD PIPE.

QUALITY YOUNGSTOWN SERVICE

Youngstown STEEL PIPE

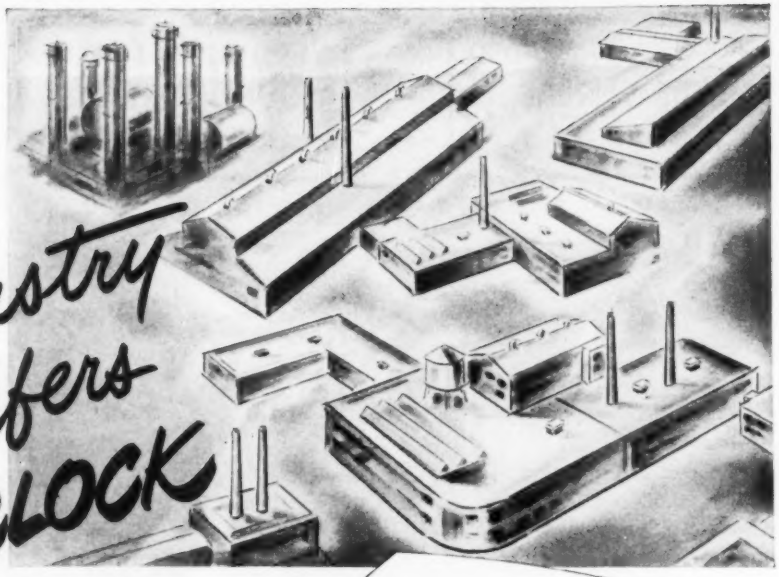
THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices — Youngstown 1, Ohio

Export Office-500 Fifth Avenue, New York

PIPE AND TUBULAR PRODUCTS - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - HOT AND COLD FINISHED CARBON AND ALLOY BARS - RODS - SHEETS - PLATES - CONDUIT - RAILROAD TRACK SPIKES



Industry Prefers GARLOCK

because of—

1. **Research**—brings improved Garlock products to meet changing needs.
2. **Quality**—high quality is assured by quality-controlled construction throughout.
3. **Service**—helpful service calls by Garlock representatives and complete factory cooperation.
4. **Complete Line**—of Garlock products for every kind and type of service.
5. **Long Life**—Garlock products give long, dependable service because of their uniform fine quality.

GARLOCK packings and gaskets won first place by a substantial margin in a nation-wide industrial survey recently conducted by an independent firm.

We aim to maintain this position of leadership by continued adherence to the highest standards of quality and service.

Illustrated below is one of the many popular GARLOCK packings which are giving exceptional service in thousands of plants throughout the world.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK

In Canada: The Garlock Packing Company of Canada Ltd., Montreal, Que.

GARLOCK 430
Chevron* Packing

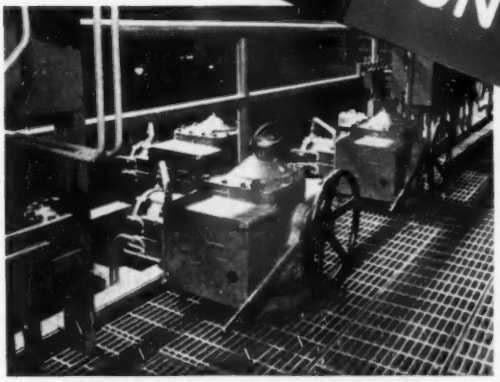
*Reg. U. S. Pat. Off.

GARLOCK PACKINGS, GASKETS AND OIL SEALS

good reading...

..and PROFITABLE, too

For remote or local control . . . positive, speedy, safe, dependable opening and closing all types of valves, and automatic operation of doors, ventilators, damper controls, etc., equip with LimiTorque. Can be actuated by any available power source . . . electricity, water, steam, gas, air, etc. Your valve manufacturer can supply them.

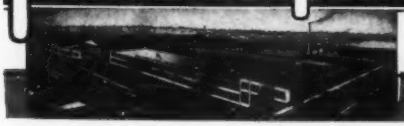


Three air actuated LimiTorque Automatic Controls operating High Pressure Boiler Feed Valves at a large, modern power generating station.

for the man interested in REMOTE VALVE OPERATION

This new Catalog L-50 tells all about LimiTorque Controls . . . describes the various types and shows many of the outstanding installations. It is a dependable guide to planning new constructions or modernizing older ones . . . a veritable treatise on *motorized valve operation*. For your copy write today, but use your Business Letterhead, please.

Philadelphia Gear Works, INC.



ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON
IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

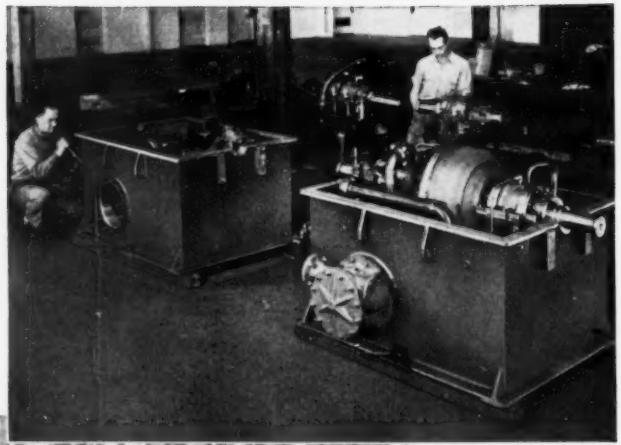
Gýrol FLUID DRIVES

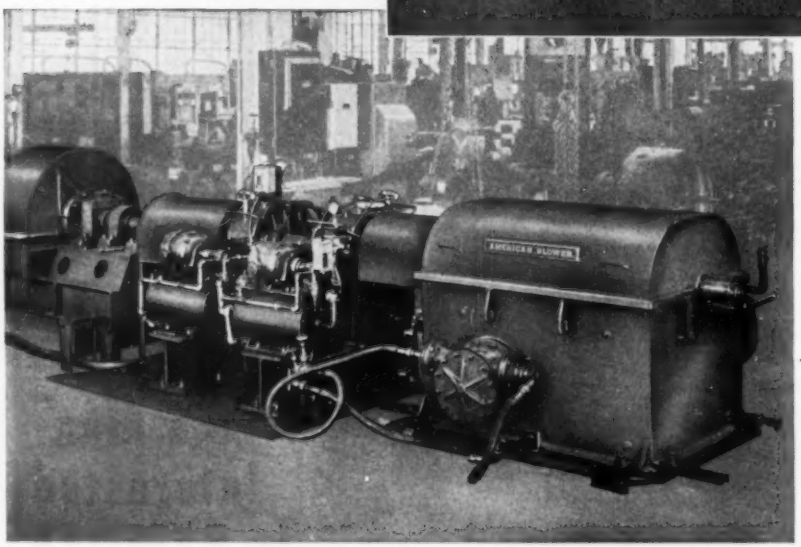
for

THE DETROIT EDISON COMPANY

CONNERS CREEK POWER PLANT

Ever-increasing demand for electric power has prompted still another of America's great public utilities to expand and enlarge its facilities and services.





Above are shown 2 of the Type VS Class 6 Gýrol Fluid Drives for boiler feed pumps, in process of assembly. A total of 6 will be used in The Detroit Edison Company's Conners Creek Power Plant. The duty of each is 1200 HP at 3600 RPM. This order is a duplicate of 6 units now in operation at their Trenton Channel Power Plant.

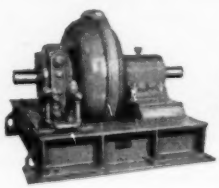
Each unit is given a thorough run-in test. The narrow range of speed over which a boiler feed pump must operate requires very accurate control and this is insured by thorough testing and inspection at each stage of construction.

American Blower Type VS, Class 6 Gýrol Fluid Drive is designed especially for the heavy duty required of high speed boiler feed pump drives. It offers to power plant operators such important advantages as power savings, flexibility of control, lower pressures and reduced maintenance. For complete, concise, factual data on these unique drives—write, stating your requirements, or phone our nearest Branch Office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN

CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation



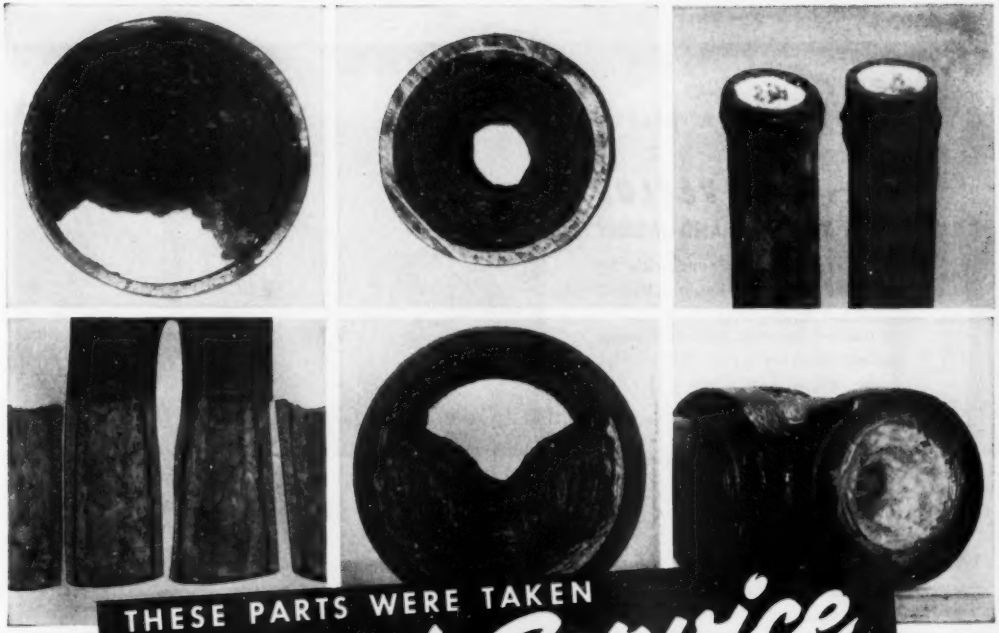
Gýrol Fluid Drives

for Mechanical Draft Fans are also a part of American Blower's wide range of products which serve America's leading public utilities.

YOUR BEST BUY AMERICAN BLOWER POWER PLANT EQUIPMENT

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON



THESE PARTS WERE TAKEN

Out of Service

BECAUSE OF SCALE

DEARBORN FORMULA 134 ELIMINATES SCALE

● These destroyed parts represent a large, unnecessary investment in equipment, labor and shut-down time. Conditions like these can easily and economically be avoided with Dearborn Formula 134. Wherever water travels—scale tends to form. Formula 134 is a concentrated solvent for the rapid removal of scale in heat exchange units, boilers, pumps, feed lines, meters, condensers and other valuable equipment.

Formula 134 is just one of many Dearborn formulas used to save equipment, reduce shut-down time and maintenance costs. Other Dearborn formulas control acidity of condensate, prevent excessive foaming and prevent corrosion of metal in contact with calcium and sodium chloride refrigerating brines. For the correct water treatment to best meet your needs—consult Dearborn.

DEARBORN CHEMICAL COMPANY
310 S. Michigan Ave. • Chicago 4, Ill.

SAFE, SIMPLE APPLICATION

with specially designed, inexpensive pump also supplied by Dearborn! Send for Bulletin 5002 which describes in detail methods for the removal of scale with Dearborn Formula 134.

DEARBORN CHEMICAL COMPANY
310 S. Michigan Ave., Dept. PO
Chicago 4, Illinois
Gentlemen:
Please send me information on Dearborn Formula 134.

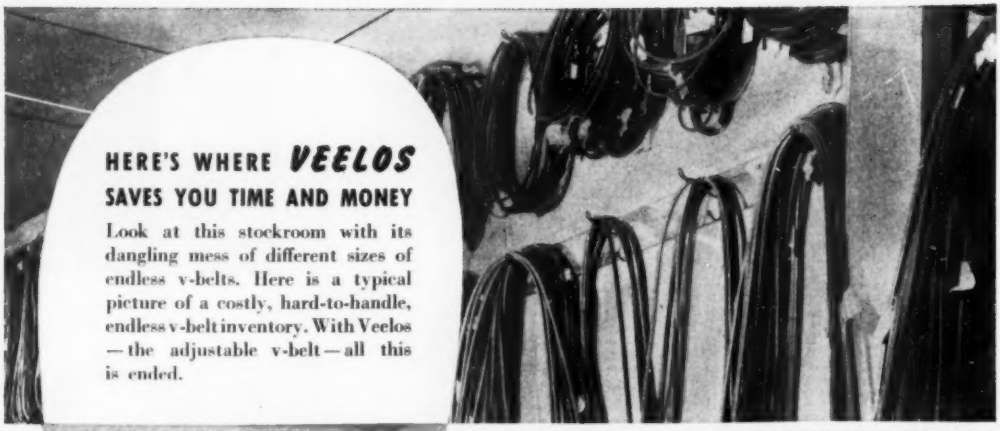
Name.....
Company.....
Address.....
City.....State.....

Dearborn

TRADE MARK REGISTERED

THE LEADER IN WATER TREATMENT AND RUST PREVENTIVES

WATER TREATMENT AND SOFTENING COMPOUNDS • COMPLETE ENGINEERING SERVICE • NO-OX-ID RUST PREVENTIVES



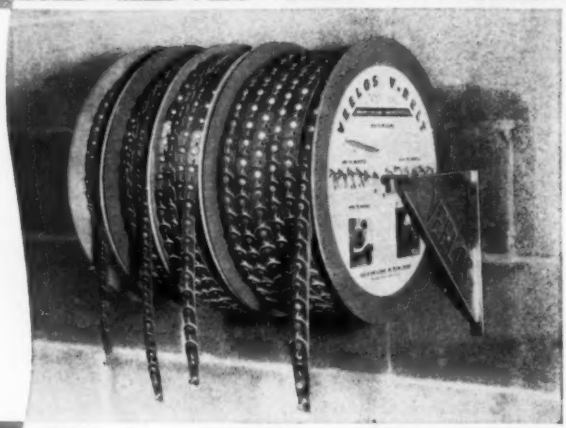
HERE'S WHERE *VEELOS* SAVES YOU TIME AND MONEY

Look at this stockroom with its dangling mess of different sizes of endless v-belts. Here is a typical picture of a costly, hard-to-handle, endless v-belt inventory. With Veelos—the adjustable v-belt—all this is ended.

WITH *VEELOS*, ANY BELT SIZE IS ALWAYS ON HAND

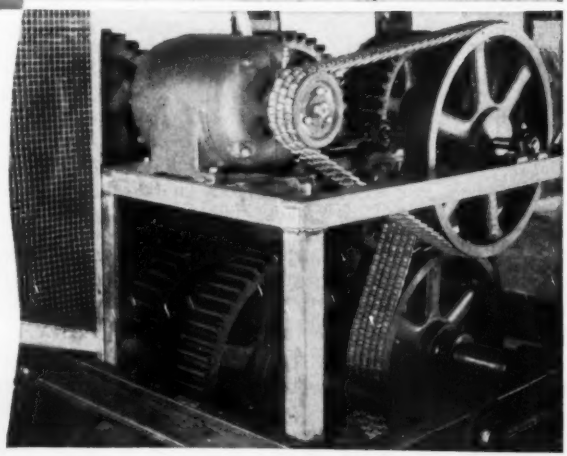
These four reels of Veelos alone can *replace* up to 316 sizes of endless v-belts in the O, A, B and C widths. No more stockroom troubles, no more replacement headaches because Veelos is *always* ready—in the widths you require.

If you are interested in reducing your v-belt costs and increasing your production efficiency, you should have a Veelos Data Book. For free copy of this illustrated book complete with engineering information write*



VEELOS ASSURES MAXIMUM MACHINE PRODUCTION

Veelos is easy to install *without* dismantling outboard bearings. Veelos runs true for vibrationless, full power delivery. Because Veelos is adjustable, uniform belt tension is easily maintained.



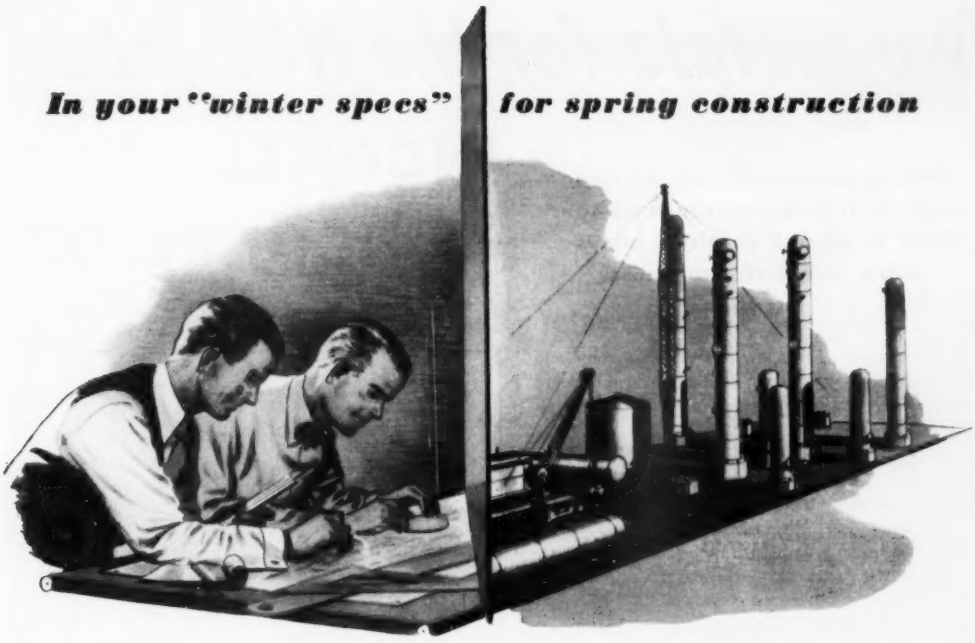
VEELOS
THE LINK
V-BELT

ADJUSTABLE TO ANY LENGTH • ADAPTABLE TO ANY DRIVE

Made in all widths in three types: regular, oil-proof, static conducting. Also double V in A and B. Packaged on reels in 100-foot lengths. Sales engineers in principal cities; over 350 distributors throughout the country. Veelos is known as VEELINK outside the United States.

***MANHEIM MANUFACTURING & BELTING COMPANY, MANHEIM, PA.**

In your "winter specs" for spring construction



It will pay you to consider these four advantages of a Fluor Pulsation Dampening Piping System . . .

1. **Pressure drop calculation based on smoother flow**
2. **Improved gas metering accuracy**
3. **Virtual elimination of piping maintenance**
4. **Consideration of safety records**

The Fluor Pulsation Dampening Piping System is the newest and most practical approach to "pulse-free" piping yet developed. Designed primarily for installation in new construction utilizing piping to handle air, steam, or hydrocarbons at operating pressures ranging from a vacuum to 5,000 psi at any temperature, this Fluor-designed piping system removes objectionable pulse peak pressures caused by the reciprocating action of compressors.

Fluor Pulsation Dampening Piping Systems are *guaranteed* to provide a virtually smooth gas flow with minimum pressure drop. Safety is increased by eliminating vibrational stress on piping, heat exchangers and vessels. Compressor operating efficiency is increased, metering inaccuracies caused by pulsative flow are reduced, and maintenance problems common to conventional piping systems are cut to a minimum.

If you are in the process of drawing up specifications for current or contemplated construction involving compressor piping, it will pay you to write for Fluor Bulletin No. PDS-8501. Or, contact your nearest Fluor Representative for attention to your particular problem.

FLUOR "PACKAGE-TYPE" PULSATION DAMPENERS

Fluor offers two "Package-Type" Pulsation Dampeners for installation in already existing piping systems. The first, a Fundamental Pulsation Dampener alleviates objectionable pulse frequencies contributing to vibration and pulsation of compressor piping. The second, a Higher Frequency Pulsation Dampener, removes the offending pulse frequencies in the higher range and is competitive in cost with muffler or snubber-type devices.

FLUOR

Fluor Pulsation Dampeners and Pulsation Dampening Piping Systems are protected by U. S. and foreign patents issued and pending.

BE SURE WITH FLUOR

DESIGNERS AND CONSTRUCTORS of Refining, Natural Gas and Chemical Processing Plants.
MANUFACTURERS of Pulsation Dampeners, Mufflers, Gas Cleaners, Cooling Towers and Fin-Fan Units.

THE FLUOR CORPORATION, LTD., 2500 S. Atlantic Blvd., Los Angeles 22, Calif. Offices in principal cities in the U.S.A.
REPRESENTED IN THE STERLING AREAS BY: Head Wrightson Processes Ltd., Teesdale House, Baltic St., London, E.C.I., England

Two metals for the HOT jobs—

INCONEL
INCONEL "X"

Offering exceptional strength and high corrosion-resistance up to 2000° F., these high-nickel alloys solve "hot spot" problems.

With the continuing development of gas-turbine and Diesel-electric power systems, locomotive designers are becoming increasingly interested in *heat-resisting* alloys . . .

Where operating temperatures may soar well past the 1000° mark . . . as in turbine blades, exhaust systems, turbo-chargers, and steam generator fire pots . . . new and serious engineering problems must be solved. At red-heat and higher temperatures, destructive oxidation, accelerated corrosion, and heat-softening become major threats to materials of construction.

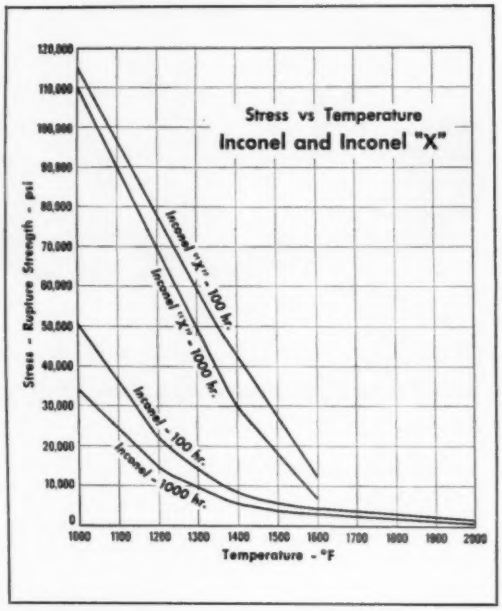
Among the relatively few metals to show satisfactory long-time performance under such severe service conditions are *Inconel** and *Inconel "X"**. Both alloys have equally good resistance to destructive oxidation at temperatures up to 2000° F. Both alloys are workable. And both alloys are *practical* in cost.

Inconel serves best where a high degree of corrosion-resistance is required and where moderate hot strength is sufficient . . . as, for example, in exhaust systems, expansion joints, and combustion chambers.

But where "super" properties are needed, age-hardenable *Inconel "X"* should be specified. In addition to a corrosion-resistance equal to that of *Inconel, Inconel "X"* offers higher hot strength, particularly in the 1200° to 1500° F. range. Typical applications for *Inconel "X"* are: turbine wheels and blades, structural members, high-temperature springs and fastenings.

In short . . . for applications where its higher cost is warranted, call for *Inconel "X"*. But for most "every day" high heat jobs, specify economical *Inconel.*

If you are concerned with metal specification, your reference files should contain full engineering information about these two heat-defying Inco nickel alloys. Write for it . . . today. And remember, too, that our Technical Service Department is always ready to help you solve metal-selection and fabrication problems.



INCONEL *"X" is age-hardenable and offers exceptional mechanical properties as well as high resistance to destructive oxidation.*

INCONEL *provides an economical answer to most high-temperature metal problems, where moderate hot strength is sufficient.*

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

*Reg. U. S. Pat. Off.

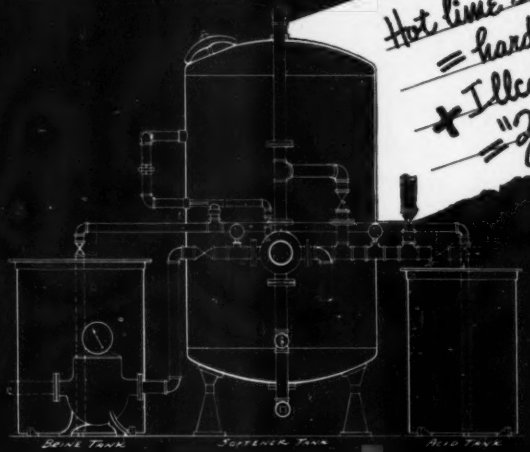
EMBLEM OF SERVICE
NICKEL INCO ALLOYS

MONEL® • "K"® MONEL • "R"® MONEL • "KR"® MONEL • NICKEL • "D"® NICKEL
"L"® NICKEL • INCONEL® • DURANICKEL® • PERMANICKEL® • INCONEL "X"®

"ZERO" SOFT WATER

from your hot-process unit without chemical after-treatment

Hot lime soda softener + filtration
= hardness 2-3 grain/gal.
+ Illco-Temp softener
= "zero" soft boiler feedwater



ILLCO-TEMP SOFTENER*
is a product of
ILLCO-WAY ionXchange research

*process patent pending

No chemical after-treatment necessary to reduce hardness for "ZERO" Soft Water obtained from the ILLCO-TEMP Hot Process Unit.

Chemical Savings from this alone will normally pay for equipment in less than 2 years.

Advantages of ILLCO-TEMP

Provides "zero" soft water regardless of variations in the hot process effluent

Decreases the excess dosages required for straight hot-process

Reduces amount of chemicals required in boiler (none are needed for hardness control)

Eliminates frequent adjustment

Eliminates deposits which result in "plugging" in valves, feed pumps, feed lines, heaters, etc.

Other ILLCO-WAY equipment

DE-IONIZING for solids-free water—ILLCO-WAY De-ionized water *replaces distilled water* at a fraction of distilled water's cost!

DE-ALKALIZING for reduction of alkalinity—ILLCO-WAY De-alkalizing equipment produces water suitably low in alkalinity, reduced in solids content, and free of hardness.

SOFTENING for conversion of hardness—ILLCO-WAY industrial softening equipment is found in leading plants.

Add it to your present hot lime-soda water softener...easily and at low cost

Power engineers are obtaining real operating economies from a new water softening process that consistently shows "zero" hardness. The net result is that scale-forming salts are eliminated—doing away with scale deposits in the lines, pumps, pre-heaters, and the boilers themselves.

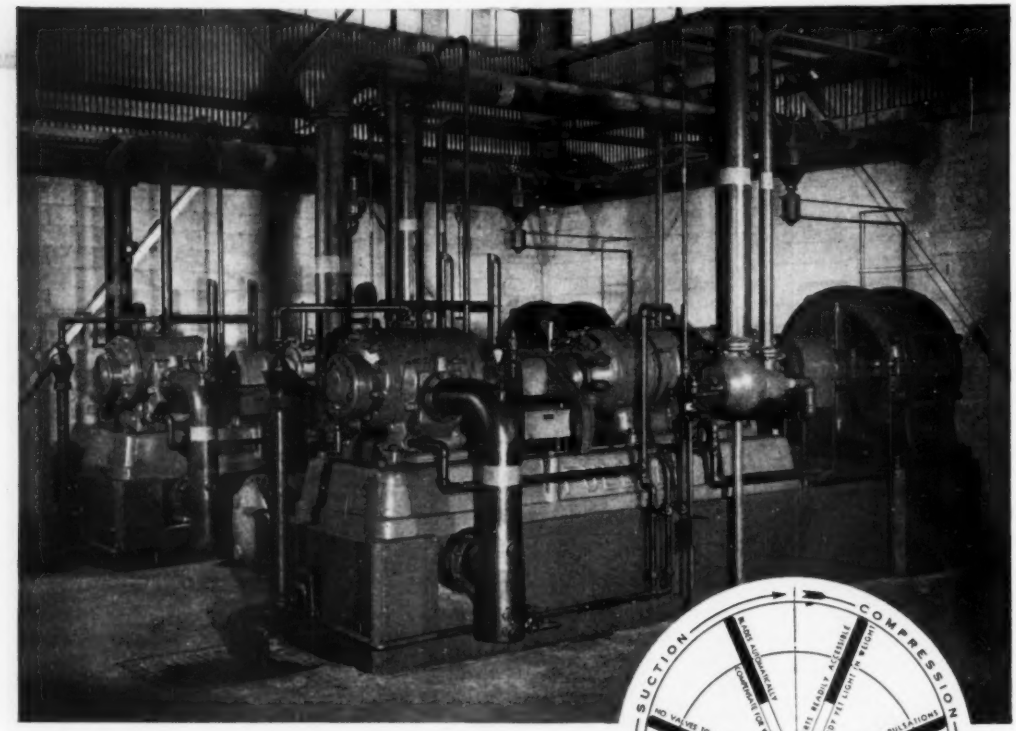
This is the only method today that withstands high or low pH at high temperatures. The ILLCO-TEMP Softener unit operates economically and continuously at temperatures as high as 250° F or higher...on waters having a pH as high as 10.5. This eliminates the need for a constant control and adjustment of the hot lime-soda dosage, as previously required.

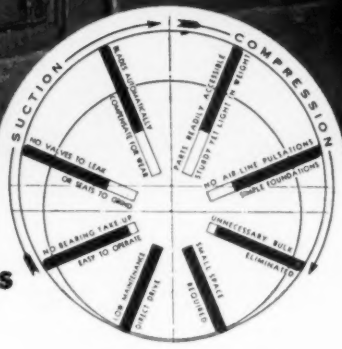
The ILLCO-TEMP unit is approximately the same size as your hot-process *filter*, and is easily added to your present equipment...Write for engineering details and case histories today.

ILLINOIS WATER TREATMENT CO., 853-2 Cedar St., Rockford, Ill.
New York Office: 7310-NN-2 Empire State Bldg., New York City

ILLCO-WAY
DE-IONIZING
DE-ALKALIZING
SOFTENING

ENGINEERING AND EQUIPMENT—DE-IONIZERS for process water treatment and treatment of liquids and solutions other than water; waste treatment; reclamation of specific constituents. DE-ALKALIZERS: Boiler feed (external); Bottling water. SOFTENERS: Industrial, Domestic. FILTERS, etc.





AIR ISN'T FREE!

but with FULLER rotary compressors IT NEED NOT BE COSTLY

Problem: To secure a dependable, economical source of air power for the cold-reduction sheet and tinplate mill of the Columbia Steel Co. at Pittsburg, Calif.

Solution: Two Fuller Two-Stage Rotary Compressors were installed. Each, driven by a 600-rpm. synchronous motor, delivers 1660 cfm. at 125 psig. Each is equipped with intercooler, regulator, and intake filter-silencer unit. In addition, complete full-magnetic electrical-control equipment is provided.

Fuller Rotary Compressors are built to provide a lifetime of new machine efficiency. They're sturdy, dependable—and because they have a minimum of moving parts—rotor, bearings and blades—they require minimum attention. There are no valves to leak, no seats to grind. Blades automatically compensate for wear. No detail has been overlooked that makes for long-term, trouble-free service at the lowest possible maintenance and operating costs.

Let a Fuller Engineer show you how they pay off in dependable service and long life.

FULLER COMPANY, Catasauqua, Pa.
120 S. LaSalle St., Chicago 3 • 420 Chancery Bldg., San Francisco 4

fuller

DRY MATERIAL CONVEYING SYSTEMS AND COOLERS
COMPRESSORS AND VACUUM PUMPS
FEEDERS AND ASSOCIATED EQUIPMENT

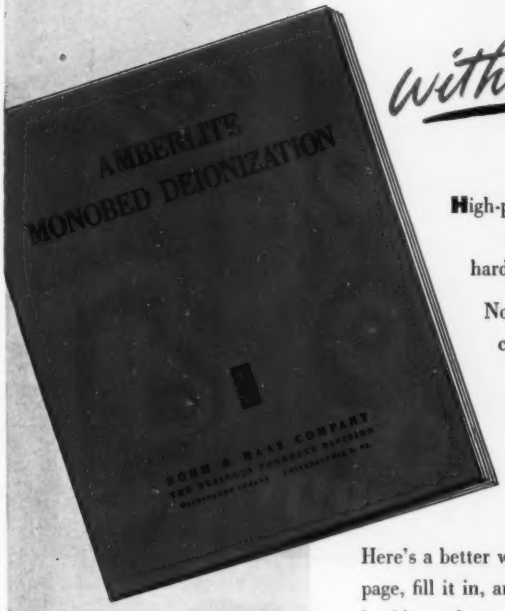
C-198

Now— by AMBERLITE MONOBED DEIONIZATION

ZERO SILICA • ZERO HARDNESS • ZERO CARBON DIOXIDE

ZERO TOTAL IONIZED SOLIDS

without Evaporation!



High-pressure-boiler feedwater—passed *once* through a *single* bed of AMBERLITE ion exchange resins—is free of silica, hardness, carbon dioxide . . . of essentially all ionized solids.

No fuel is consumed, no heat is lost, no shutdowns for cleaning are needed. The cost of equipment—and of its operation—is low. The treated water contains less than one-tenth of one part of ionized solids per million parts of water—no matter how poor the quality of your raw water supply. And alkalinity is . . .

But we're getting ahead of our story.

Here's a better way to tell it. First, clip the coupon at the bottom of this page, fill it in, and mail it to us. When you've had a chance to read the booklet, ask your consulting engineer or manufacturer of water conditioning equipment how AMBERLITE Monobed deionization can insure the life and efficiency of your high-pressure boilers. Or, if deionization in *one* ion exchange unit doesn't quite suit your special needs, ask him how high quality water can be produced by various combinations of AMBERLITE cation and anion exchange resins, operating in *separate* units.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

Washington Square Philadelphia 5, Pa.

The Resinous Products Division was formerly The Resinous Products & Chemical Company

AMBERLITE is a trade-mark, Reg. U. S. Pat. Off. and in principal foreign countries.

ROHM & HAAS COMPANY

Washington Square, Philadelphia 5, Penna.

Please send me your new 16-page booklet, "AMBERLITE Monobed Deionization".

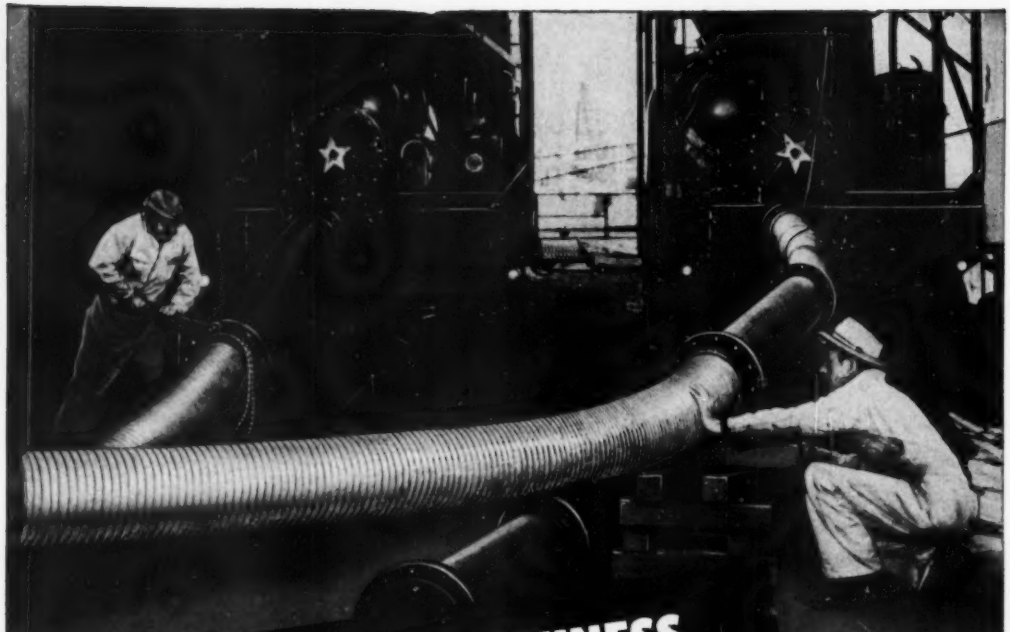
Name_____

Title_____

Company_____

Address_____

City_____ State_____



TONS OF TOUGHNESS MOVED WITH FLEXIBILITY

Penflex Tubing Moves Abrasive Copra

Provides Flexibility . . . Absorbs Vibration . . . Withstands Abrasion

When tough copra, the dried kernel of the cocoanut, moves through pneumatic conveyors . . . ordinary tubes wear out. Where copra is unloaded, tubing must be flexible to accommodate changing levels and positions of the conveyor and cargo.

The answer was found in Penflex tubing installed by Penflex Engineers. Lengths of full interlocking galvanized steel flexible #20 heavy duty hose (8" and 10" I.D.) were installed. It answered every requirement—provided flexibility for free movement of hose in hold, absorbed vibration from machines, took up movement of ship due to tide changes.

You may not have a problem involving pneumatic conveyors, but if it pertains to flexible tubing, Penflex Engineers have the answer. As America's oldest manufacturer of flexible hose, Penflex offers helpful layout-design service on flexible tubing applications to all industries. For flexible metallic hose, tubing, or couplings from 1/8" I.D. and up . . . for handy, time-saving automatic barrel fillers and pneumatic rivet passers . . . for the finest in engineering service, call on Penflex. Write for your copy of "FLEXINEERING AT WORK TODAY."

Pennsylvania Flexible Metallic Tubing Company, Inc.
7238 Powers Lane, Philadelphia 42, Pennsylvania

Branch Sales Offices

BOSTON • NEW YORK • CHICAGO • HOUSTON • CLEVELAND • LOS ANGELES

Penflex... HEART OF INDUSTRY'S LIFE LINES

No Other Water Conditioning System Has All of These Features...

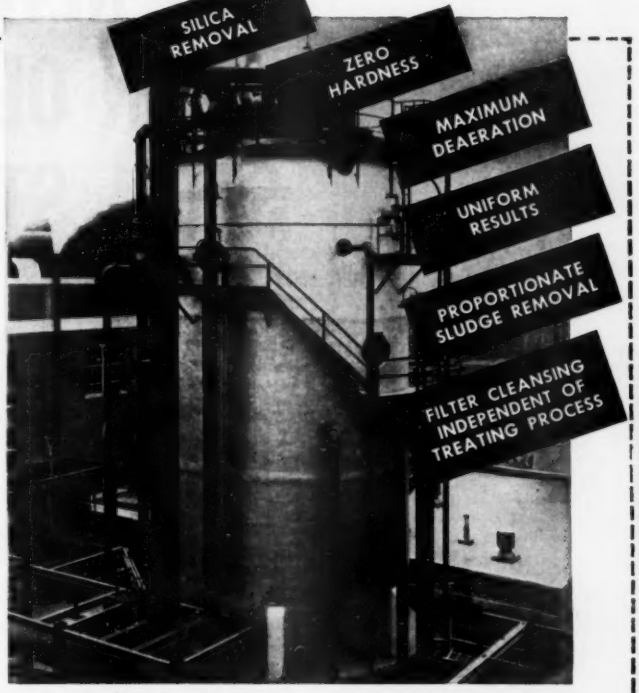
...ALL IN ONE TANK:

YES, you get all these and more, too, in one tank without the aid of internal mechanical agitation or other moving parts when a water conditioner like this 900,000 lb. per hour Worthington installation treats your make-up or condensate water.

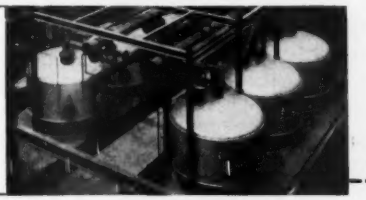
In less space you get all the heating, chemical feeding and clarification facilities to provide optimum water conditioning results. Worthington's engineering skill and complete manufacturing facilities offer you the advantages which can only result from carefully coordinated effort under one responsibility.

WRITE FOR FACTS

For proof that, in water conditioning as in so many other services, *there's more worth in Worthington*, write for Bulletin W-212-B2. *Worthington Pump and Machinery Corporation, Water Treating Division, Harrison, N. J.*

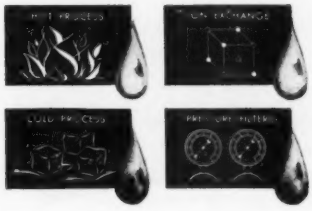


Main treating tank of a Worthington Hot Process Water Conditioning System, capacity 900,000 lb. of treated water per hour



Six pressure filters 11 feet in diameter used for final clarification in this Worthington Hot Process Water Conditioning System

JB-3



WORTHINGTON

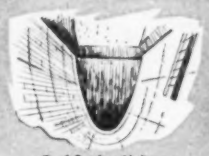
WATER CONDITIONING

Worthington Makes More of the Equipment For All Types of Water Conditioning Systems

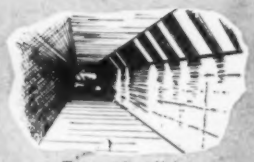
WHERE TO USE LUMNITE IN POWER PLANTS

Steel Stack Linings

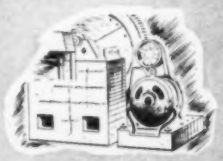
Ash Pit and Cinder Catcher Linings



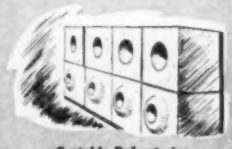
Coal Bunker Linings



Flue and Duct Linings



Overnight Structural Concrete



Castable Refractories

Factory-prepared mixtures of LUMNITE and selected aggregates. Mixed with water on the job, cast into place for door linings, arches, baffles, furnace walls. Special shapes can be cast in molds, ready within 24 hours. Castables to meet different temperature and insulation needs are made by manufacturers of Refractories, sold by their distributors.

Linings made with LUMNITE*

PUT NEW LIFE IN OLD STEEL STACKS

A Lumnite-Haydite lining gives this National Tube Company stack a new lease on life. One of five stacks recently lined, it is now protected against corrosion and the abrasive action of high-velocity gases and fly ash, especially in the breechings. Drafts will be boosted, too, because the lining is smooth and jointless, with good insulating qualities.

Stacks are just one of the profitable uses for insulating concrete made with Lumnite calcium-aluminate cement. Lumnite, with suitable aggregates, is ideal for baffles, furnace walls, arches, door linings...virtually anywhere that heat is a problem.

Easily Installed—Maintenance Reduced. Lumnite linings may be readily troweled into place or "shot" on by cement gun. Thus, there are no small units to work loose; maintenance is lessened. When repairs are necessary, they can be made quickly and cheaply, for Lumnite reaches full service strength in 24 hours or less.

For further information, write Lumnite Division, Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, N. Y.

**"LUMNITE" is the registered trade mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.*

P-L-40

ATLAS® LUMNITE for INDUSTRIAL CONCRETES

REFRACTORY, INSULATING, OVERNIGHT, CORROSION-RESISTANT

A UNIVERSAL ATLAS PRODUCT

"THE THEATRE GUILD ON THE AIR"—*Sponsored by U. S. Steel Subsidiaries—Sunday Evenings—NBC Network*

"For high dust collection efficiency CONSIDER THESE FACTS!"

95% to 99% REMOVAL

Your specific needs determine the exact percentage of fly ash removed by a Research Corporation Cottrell Precipitator.

LOW DRAFT LOSS

The pressure drop between inlet and outlet of the Cottrell is extremely low, averaging *only a few tenths of an inch of water.*

DURABILITY

Low velocities hold abrasion to a minimum.

ANY CAPACITY

Cottrell precipitators have been used successfully with both small boilers and the very large boilers developed in recent years.

OTHER APPLICATIONS

Cottrell precipitators have wide application in the recovery of other materials such as acid mist, blast furnace dust, sodium salts, fluid catalyst and valuable metals from smelters.

YOU GET all these important advantages PLUS Research Corporation's 38 years of experience in the field of electrical precipitation. Every Cottrell installation is individually engineered to do the most efficient job. For more facts about Research-installed Cottrells, send for Bulletin 500.

RESEARCH CORPORATION

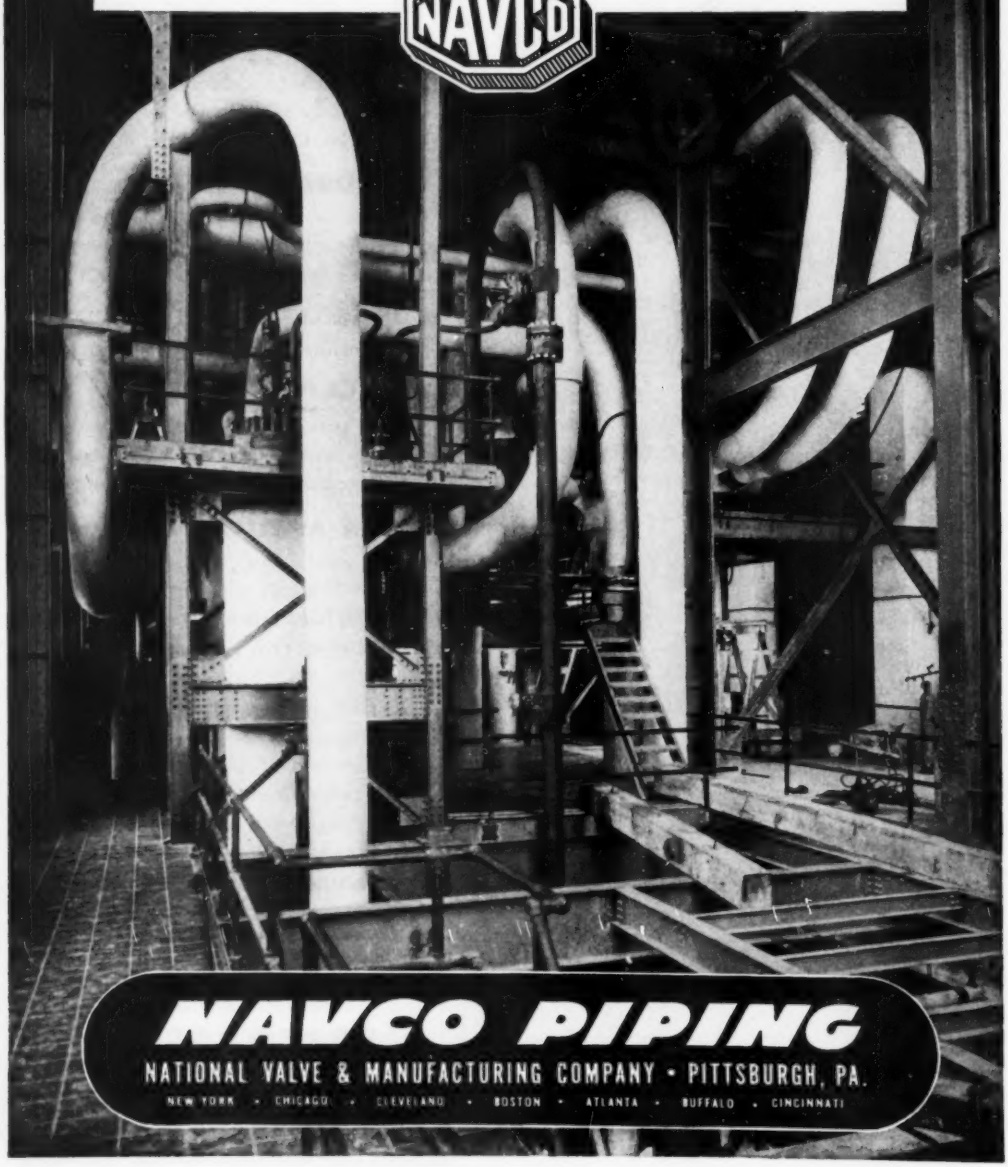
405 Lexington Avenue, New York 17, N. Y.
122 South Michigan Avenue, Chicago 3, Illinois

It pays to get NAVCO'S "Know How" and experience in High Pressure and High Temperature piping

For almost half a century Navco has specialized in the fabrication and erection of Piping Systems for the highest operating conditions.

The experience gained throughout that period is your assurance of obtaining from Navco, a Piping System of the highest order.

NAVCO



NAVCO PIPING

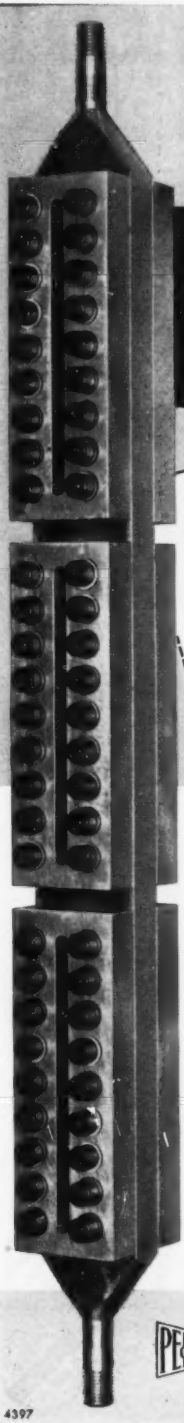
NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.

NEW YORK • CHICAGO • CLEVELAND • BOSTON • ATLANTA • BUFFALO • CINCINNATI

for operating pressures up to

10,000 psi

PENBERTHY transparent LIQUID LEVEL GAGES



Another PENBERTHY First

Patent Applied for

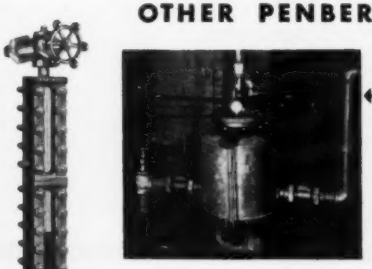
These gages were developed by Penberthy in answer to persistent demands from the process industries and various laboratories for a gage with UNOBSTRUCTED VISIBILITY at service pressure ratings up to 10,000 psi. They are tested to 15,000 psi. Temperature rating is 250° F dry gas . . . 300° F wet gas.

In addition to their value as liquid level indicators, these gages are useful as reaction chambers, equilibrium cells, high pressure manometers, e.c.

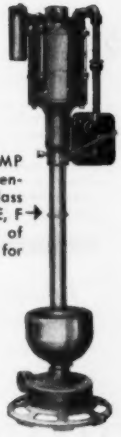
The standard gage body containing the liquid chamber is forged carbon steel but stainless steels are available. Design is such that glass is entirely relieved of bolting pressure . . . providing a better seal and avoiding those stress concentrations which cause so much glass breakage.

These Penberthy 10,000 psi gages are of proven dependability . . . they have been in field service for more than two years. Write us regarding your requirements.

OTHER PENBERTHY PRODUCTS



PENBERTHY CYCLING JET PUMPS. Automatically operated by air, gas or steam pressure . . . Will pump without clogging any liquid that will flow through pipes. Ask for Bulletin 5030.



PENBERTHY EXPLOSION-PROOF SUMP PUMPS. Motor and switch totally enclosed. Underwriter approved for Class 1, Group D, and Class 2, Groups E, F and G hazardous location. Made of copper and bronze throughout. Ask for Bulletin 4929.

PENBERTHY REFLEX GAGE. Empty space shows white, liquid shows black. You can't misread. Available in special alloys and now available for operating pressures up to 5,000 psi. Ask for Catalog 35.

PENBERTHY EJECTORS. A simple jet pump operated by air, water or steam. Needs no lubrication . . . will not get out of order. Ask for Bulletin 5080.

PENBERTHY ALSO MANUFACTURES A COMPLETE LINE OF LIQUID LEVEL GAGES IN BRONZE, IRON, STEEL AND ALLOYS

PENBERTHY INJECTOR COMPANY

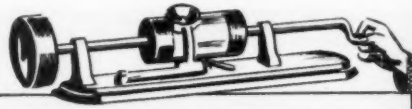
DIVISION OF THE BUFFALO-ECLIPSE CORPORATION

DETROIT 2, MICHIGAN

Established 1886 *Canadian Plant, Windsor, Ontario*

4397

Within one year . . . *In 1878, Edison had invented "the speaking machine." Less than a year later, we were making Consolidated Safety Valves. Today, the Consolidated "Maxiflow" Safety Valve embodies our entire knowledge —over 70 years—of valve engineering, design, selection of the right metals and, above all, the ultimate in service and safety.*



CONSOLIDATED

Maxiflow Safety Valves

The increasing unit size and operating requirements of high-pressure, high-temperature steam generating equipment *virtually dictated* the design and development of the Consolidated "Maxiflow" Safety Valve. These valves, *new in all that modern engineering can contribute,* have established new standards of safety and service. Tested and performance-proved both in the shop and in the field, the "Maxiflow" meets all demands of today's large steam generating installations.

Design and operating "Maxiflow" features include:

The Thermodisc Seat permits rapid equalization of temperature differentials. Thermal stresses are minimized, seat distortion is prevented, permanent tightness is achieved.

Mechanical Through Bushing with precision-machined surfaces that assure constant entrance conditions for steam flow. Leakage, due to porous castings, is eliminated.

Control of Blowdown adjustable to a new, low minimum. The exclusive "micrometer" trim ring provides a simple and chatter-proof blowdown control, externally controlled and operable with valve under pressure.

Popping Point Retention is gained by combining proper compensation with materials having low coefficients of expansion.

Complete capacity tables, *description and features of the Consolidated "Maxiflow" Safety Valve are contained in Bulletin 707. We will be glad to send you a copy.*

See your local distributor for complete information

CONSOLIDATED *SAFETY* VALVES

A Product of

MANNING, MAXWELL & MOORE, INC.

BRIDGEPORT 2, CONNECTICUT

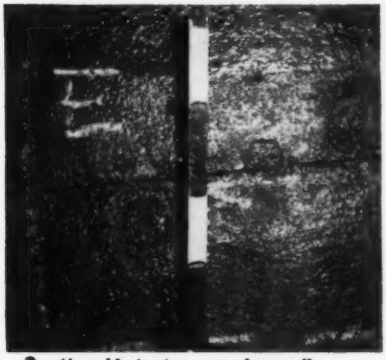
Makers of 'Consolidated' Safety and Relief Valves, 'American' Industrial and 'Microsen' Electrical Instruments, 'Hancock' Valves, 'Ashcroft' Gauges. Builders of 'Shaw-Box' Cranes, 'Budgit' and 'Load Lifter' Hoists, and other lifting specialties.

CHLORINATION BY WALLACE & TIERNAN

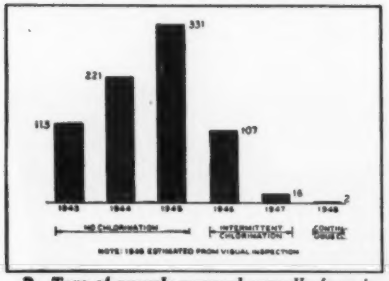
CONTROLS MARINE FOULING AT GENERATING STATION

LOOK AT THESE RESULTS

1. Before chlorination — mussels cover wall to depth of 3".



2. After chlorination — note bare wall.



3. Tons of mussels removed annually from intake tunnel of generating station.

It all began when a New England generating station sent down a diver for a routine inspection of the large, concrete, circulating-water, intake tunnel located approximately 13 feet below the harbor's surface. The diver discovered this intake was lined with unusually heavy growths of common mussel (Mytilus), sea moss (Tubularia), and sea anemone (Metridia).

These were expensive visitors. First, mussel accumulation created poor vacuum as the mussels lodged in condenser tubes and aggravated slime and silt formation. Then, as the mass increased in quantity, it became necessary to clean the intake tunnel every year to remove up to a maximum of 331 tons of mussels — a time consuming process that cost thousands of dollars in labor and equipment outage.

To combat these conditions a long and thorough study was made of marine fouling. As a result it was decided to use intermittent chlorination applied by Wallace & Tiernan Chlorinators. First to fall under this attack were the sea moss and the sea anemone. The tougher mussels however, still remained as numerous as ever.

In an all out effort to get rid of these trouble makers, continuous chlorination at heavier residuals was started. This treatment turned the trick and the mussels were reduced to such a low level that yearly cleaning has not been required.

These results saved the New England company thousands of dollars annually by eliminating intake tunnel cleaning, reducing condenser outages, and producing a higher vacuum with a resultant saving in fuel.

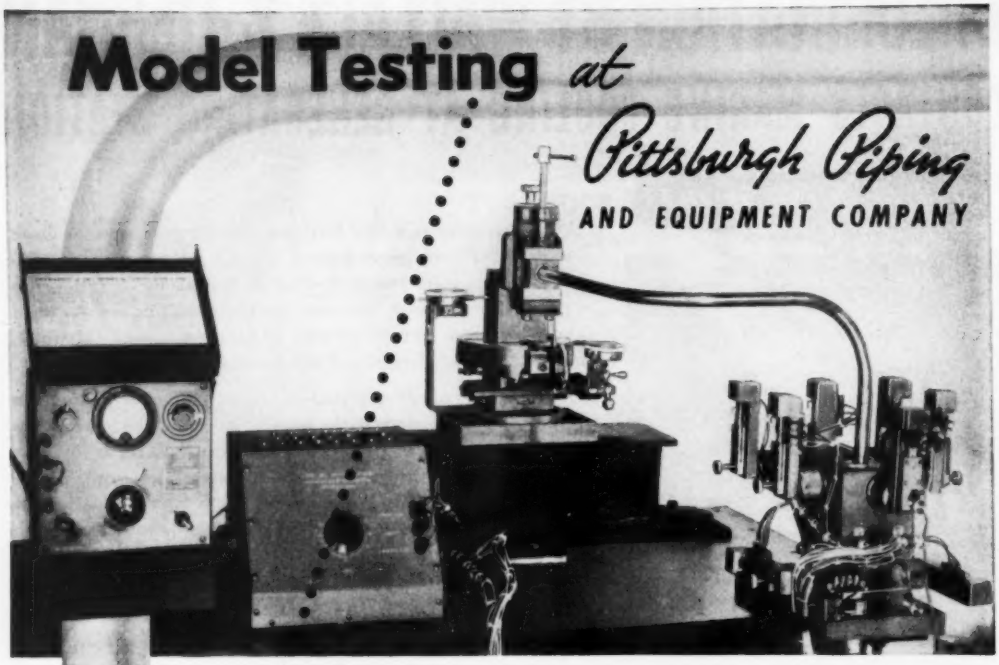
Perhaps your problem is one of slime or fouling due to some other marine organism. In any event, if biological fouling is costing you money through lowered cooling water efficiency it's a safe bet that chlorination can help.

See your nearest Wallace & Tiernan Representative now for all the details.

CD-34

WALLACE & TIERNAN
PRODUCTS, INC.
CHLORINE AND CHEMICAL CONTROL EQUIPMENT
Belleville 9, New Jersey • Represented in Principal Cities

Model Testing at Pittsburgh Piping AND EQUIPMENT COMPANY



The Modern Method for Complete, Practical Pre-determination of Piping Flexibility

Model testing is one of the many technological advancements thoroughly investigated and proved by Pittsburgh Piping and Equipment Company before being made generally available. It provides complete advance knowledge of the reactions of any type, size, and system of power piping.

The testing apparatus shown above accurately measures and directly indicates the physical reactions of a section of pipe which exactly duplicates, in miniature, the planned layout. These measurements are projected to give precise information on the full size system as a check against theoretical calculations.

On complex piping layouts, model testing provides a complete analysis instead of theoretical approximation; it is a time and labor saver; and the possibility of mathematical error is minimized. Its use helps to avoid excessive stresses, reactions, and movements in the final system which could affect joints and thus cause leakage, or damage anchors and equipment connected to the pipe line.

Look to Pittsburgh Piping and Equipment Company for leadership in methods that assure greatest safety, highest efficiency, and longest service from high temperature, high pressure piping.

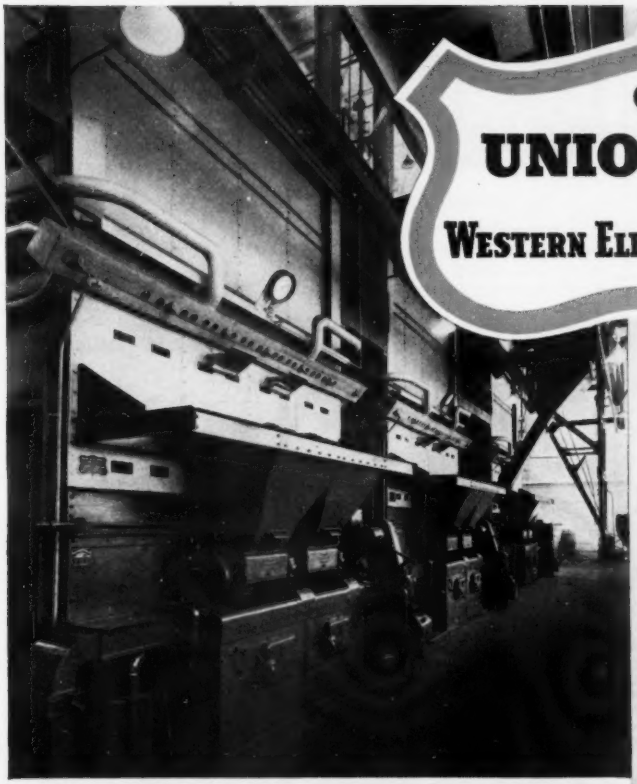
Model Testing makes possible the planning of high-pressure, high temperature piping systems with accurate advance knowledge of end reactions, stresses, and strains encountered in actual operation.

Pittsburgh Piping AND EQUIPMENT COMPANY

10 Forty-Third Street—Pittsburgh, Penna.

Woolworth Building, New York
Whitehead Building, Atlanta
Book Tower, Detroit
525 Market Street, San Francisco
Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
Heights State Bank Bldg., Houston

3 UNION BOILERS AT WESTERN ELECTRIC INDIANAPOLIS



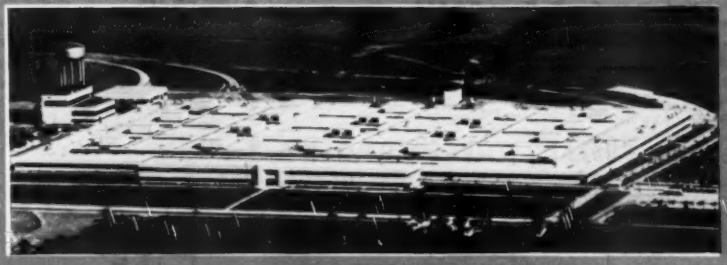
3 Union "VO" Type 60,000 lb. per hr. Steam Generators equipped with Detroit C.A.D. Spreader Stokers

THE WORLD'S LARGEST TELEPHONE SET PLANT *installs* 3 UNION BOILERS

The new Indianapolis plant of Western Electric Company Inc., began operations on November 15, 1950. It will meet the Bell System's increasing volume requirements and exacting demands for manufacture of telephone instruments.

The new Indianapolis plant will be the Bell System's primary source of telephone sets.

Union Steam Generating units are products of over a half century's experience in meeting requirements such as those of this great new Western Electric Plant. Their ability to deliver satisfactory service is recorded in repeat Union installations where expansion requires additional steam generating equipment. Your boiler requirements entrusted to our engineers are in capable hands.



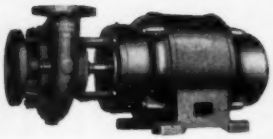
UNION IRON WORKS . . . *Since 1890*

373 CASCADE STREET • ERIE, PENNA.

BOILERS • PROCESS EQUIPMENT • FABRICATED STEEL

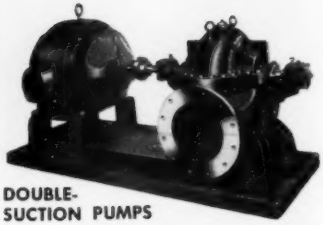
LEAD - ACID AND OTHER CHEMICAL PUMPS

"Buffalo" Chemical Pumps are available with lead lining like the pump shown, or rubber lined or of special alloys. Bulletin 982.



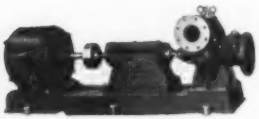
CLOSE-COUPLED PUMPS

A real space-saving design with no sacrifice in durability and efficiency. For clear water, but can be had in special alloys. Bulletin 975-B.



DOUBLE-SUCTION PUMPS

For top performance on clear water jobs, including air washers, these are of the finest materials and construction. Bulletin 955-N.



PAPER STOCK PUMPS

Diagonally-split-shell non-clogging pumps. A design for every liquid, every consistency, all proven in paper and pulp mills. Bulletin 953-F.

"Buffalo" PUMPS

MEAN MONEY SAVED THROUGH TROUBLE AVOIDED

True economy in pumping is in the pump you can install — and practically forget! "Buffalo" has always built such pumps. First cost may be a few dollars more than the "low-bidder" pump, but careful, sound "Buffalo" design and construction has always paid for itself in (1) longer years on the job, (2) fewer and shorter shutdowns, and (3) high efficiency.

As the pictures on this page show, you can pick a "Buffalo" Centrifugal Pump that's tailor-made for just about any liquid job you have. WRITE FOR BULLETINS!

BUFFALO PUMPS, INC.

488 BROADWAY BUFFALO, N.Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch Offices in all Principal Cities

— And For FANS . . .

. . . you'll find a full line of centrifugal, axial flow and propeller fans in the sizes and arrangements you want — a fan for every job! For best results on your next fan installation, look to "Buffalo". . . First For Fans. For complete information, write:

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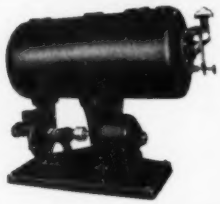


AUTOMATIC CONDENSATE PUMPS AND RECEIVERS

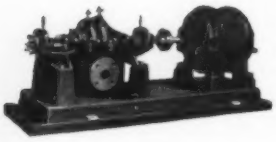
Will handle condensate at 212° F. without being affected in any way. Self-priming and trouble-proof. Bulletin 960-G.

SUMP PUMPS

Self-contained vertical units ready to install. Rugged, trouble-free, with ball-bearing thrust and enclosed shaft. Bulletin 963-F.

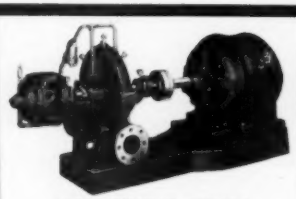
NON-CLOGGING SEWAGE PUMPS

Vertical and horizontal models for trouble-free operation in sludge circulation, agitation and removal, in lift stations and treatment plants. Bulletin 964-D.



TYPE "RR" PUMPS

For handling clear water, any temperature, at high pressures. Widely used for boiler feed. Rugged, efficient. Bulletin 980-B.

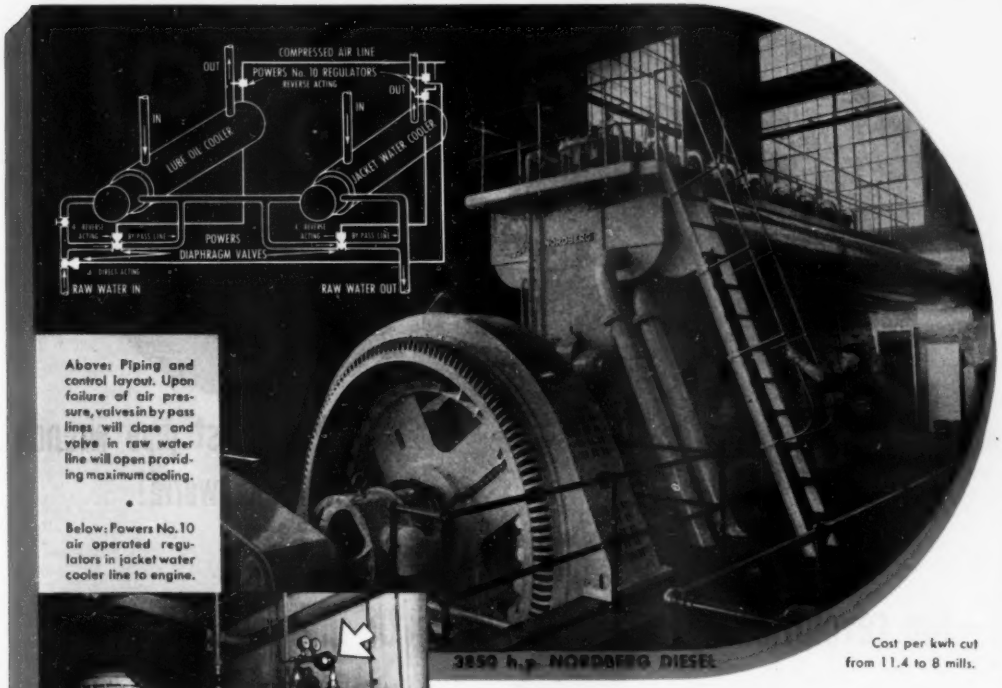


SELF-PRIMING PUMPS

Positive prime is maintained at all times. A popular feature available in all "Buffalo" Double Suction Pumps. Bulletin 970-A.

SPECIAL ALLOY PUMPS

Single suction, full ball bearing pumps, suitable for construction in most machineable alloys. Bulletin 982.

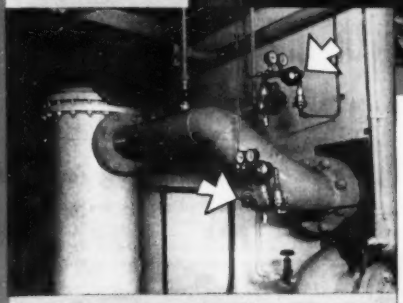


Above: Piping and control layout. Upon failure of air pressure, valves in by pass lines will close and valve in raw water line will open providing maximum cooling.

•

Below: Powers No. 10 air operated regulators in jacket water cooler line to engine.

Cost per kwh cut from 11.4 to 8 mills.



Below: Powers pneumatically controlled valves

POWERS Pneumatic Temperature Controls Help Freeport, N. Y. Light and Power Plant Reduce Costs and Increase Efficiency

With a total capacity of 17,310 h.p., Freeport, N. Y. has one of the largest municipally owned diesel-electric plants in the United States. Knowing the importance of accurate regulation of jacket water and lube oil temperatures, Chief Engineer Thomas Moore selected Powers compressed air operated controls for the Nordberg Diesel shown above, which has reduced cost per kwh 30%.

Greater Safety and Reliability of Powers pneumatic control assures correct jacket water and lube oil temperature regardless of load or seasonal changes. Accurate temperature control—improves lubrication, cylinder liner wear and reduces piston ring replacements; minimizes danger of piston seizure and sludging, reduces fuel and lube oil consumption. Cost? . . . about the same as a set of new piston rings.

With both pneumatic and self-operated regulators we may be able to help you select the type that will give better temperature control. Fill out coupon below. There's no obligation.

THE POWERS REGULATOR CO. ***Established 1891. Offices in Over 50 Cities, See Your Phone Directory***

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(D-10)

The Powers Regulator Co., 2771 Greenview Ave., Chicago 14, Illinois

Have engineer call to study our requirements for better jacket water temperature control.

Name of Engine or Compressor ..... HP .....

Your Name .....

Address .....

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it's New! it's Different!

it's the strongest pipe wrench in the world!

–the revolutionary Walworth improved Walco®

Yes, this is it . . . the **NEW** Walworth *Improved* Walco pipe wrench—with every part scientifically designed and tested by engineers for strength, safety and ease of operation. Its instant bite, and accurately determined center of gravity, combine with its inherent strength and minimum of weight to make it the fastest-working, easiest-handling, best balanced, heavy-duty pipe wrench available today . . . a wrench specially designed to minimize operator fatigue.

All parts are made of forged steel. The housing and handle are projection welded—a structural weld—to form an integral unit. Both jaws are carefully machined, and all parts are heat-treated to give extra toughness, uniformity, and strength. Every Improved Walco far exceeds the requirements for Federal Specification GGG-W-651a for Type II Heavy Duty Adjustable Pipe Wrenches.

A flexible, double-acting, easily replaceable spring—an exclusive patented Improved Walco feature—gives the wrench fast, positive ratcheting action!

Ask your Walworth distributor about the new, Improved Walco today! Heft the new, Improved Walco . . . feel its perfect balance—every part is guaranteed by the Walworth Company, doing business since 1842.

Check these outstanding features

LIGHTER: Housing and Handle are projection welded to form one integral unit.

CORRECT BALANCE: Accurate, the correct location of the center of gravity determined by test.

STRONGER: Heat treated to eliminate brittleness . . . cracking.

FAST ACTING: Scientifically designed spring action insures positive ratcheting action . . . quick bite.

CALIBRATED PIPE SCALE: Built-in scale permits speedy adjustment to pipe size.

RENEWABLE PARTS: All parts are readily obtainable, and easily replaced without special tools; thus prolonging service life indefinitely.

RUST RESISTANT FINISH: Entire wrench is rust resistant — Nut and Jaws have a special electroplated zinc coating.

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valves...fittings...pipe wrenches

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DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

SANTOPHEN 45 has proved its effectiveness in cooling towers for two years.

NEW PRODUCT
solves problem in cooling water

The problem of bacterial and algal slime control in cooling water can be solved *economically* by a new Monsanto chemical—Santophen 45. It is particularly effective in cooling waters acidified to pH 5.5 to 6.5, a common practice today.

The effectiveness of Santophen 45 (sodium trichlorophenate, technical) has been proved in two years of practical use in cooling towers with capacities up to 600,000 gallons. Results in the towers confirm laboratory findings.

Santophen 45 can be used alone or as an extender for hard-to-get slime-control agents such as chlorine, sodium hypochlorite, sodium pentachlorophenate and others. Used in combination with other slime-control chemicals, enhanced action against a wider range of microorganisms is achieved.

Santophen 45 is economical. Its use avoids the expense of tearing down condensers to remove slime deposits.

Send for test sample and availability information on Santophen 45—the chemical that solves bacterial and algal slime problems. Contact the nearest Monsanto Sales Office, or MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri.

Santophen: Reg. U. S. Pat. Off.

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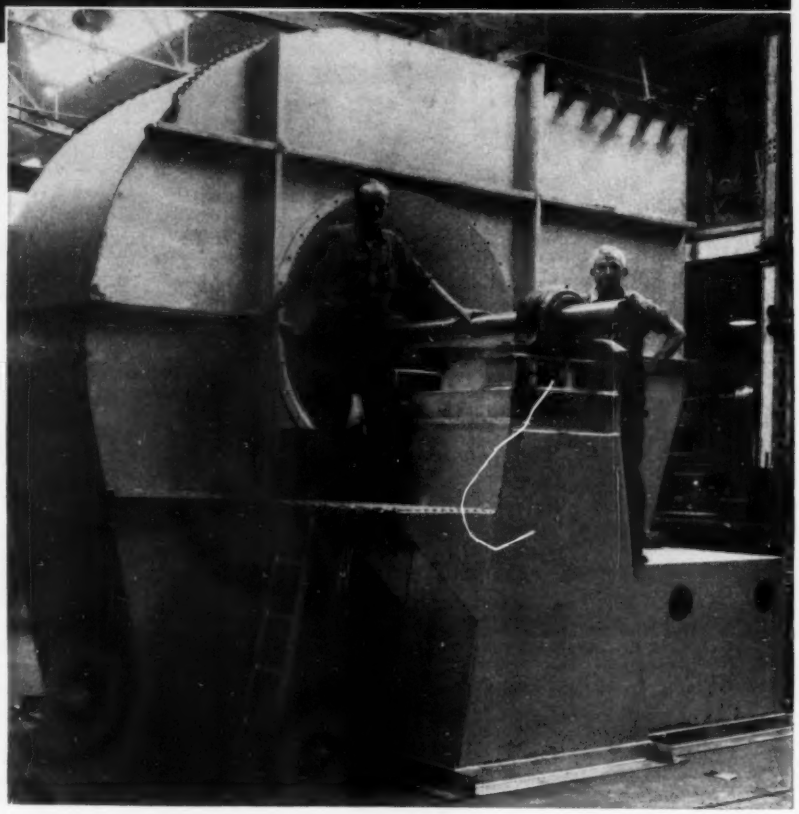
HEAVY Construction . . . Extra Years of Service



ONE OF THE LARGEST EXHAUST FANS EVER BUILT — 14 feet high, 14½ feet wide, 11 feet deep — weight, 16,250 pounds . . . two of these fans sold by Clarage Chicago office late last year to operate as essential parts of the equipment required to dry freshly mined coal.

88,600 CUBIC FEET OF AIR PER MINUTE AT 275° F. is each fan's capacity . . . fan wheel is central disc type with cast steel hub and ⅜" (thick) steel blades . . . shaft and bearings, 6½" diameter. This heavy construction of Clarage Fans will be long appreciated on this unusually severe service job.

SEE OUR CATALOG IN SWEET'S

Equipment for many of the biggest, most important air handling jobs in the country is furnished by Clarage. Through the years architects, engineers, contractors, users have come to rely on Clarage equipment for long time service at operating and upkeep costs surprisingly low. May we "work with you" on your next job in our field?

CLARAGE
FAN COMPANY
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HEADQUARTERS for Air Handling and Conditioning

SALES APPLICATION OFFICES . . . . . IN ALL PRINCIPAL CITIES

Utility hose of 101 uses around the plant or in the field . . .

Top photo—CMH REX-TUBE Type RT-15 being used to steam out a storage tank. Middle photo—CMH REX-TUBE Type RT-15 used as a gas connection for a furnace. Bottom photo—CMH REX-TUBE Type RT-15 used for unloading a tank car.

CMH REX-TUBE Interlocked Flexible Metal Hose

IF you convey steam, tar, asphalt, vegetable oils, hydrocarbons or similar substances between relatively movable parts, CMH REX-TUBE Type RT-15 flexible metal hose does the job economically and dependably. REX-TUBE Type RT-15 combines the long life and durability of metal with an exceptionally high degree of flexibility. Further, it is non-aging, non-contaminating and non-collapsible.

REX-TUBE Type RT-15 is of fully interlocked design in bronze or steel with asbestos packing. (See cross-section above.) Suitable for temperatures up to 600° F; pressures to 500 psi. Sizes range from ½" I.D. through 12" I.D.

Data sheets including specifications are available on request. Write, today!

Flexon identifies CMH products that have served industry for over 48 years.

CHICAGO METAL HOSE Corporation

1301 S. Third Avenue • Maywood, Illinois • Plants at Maywood, Elgin and Rock Falls, Ill.
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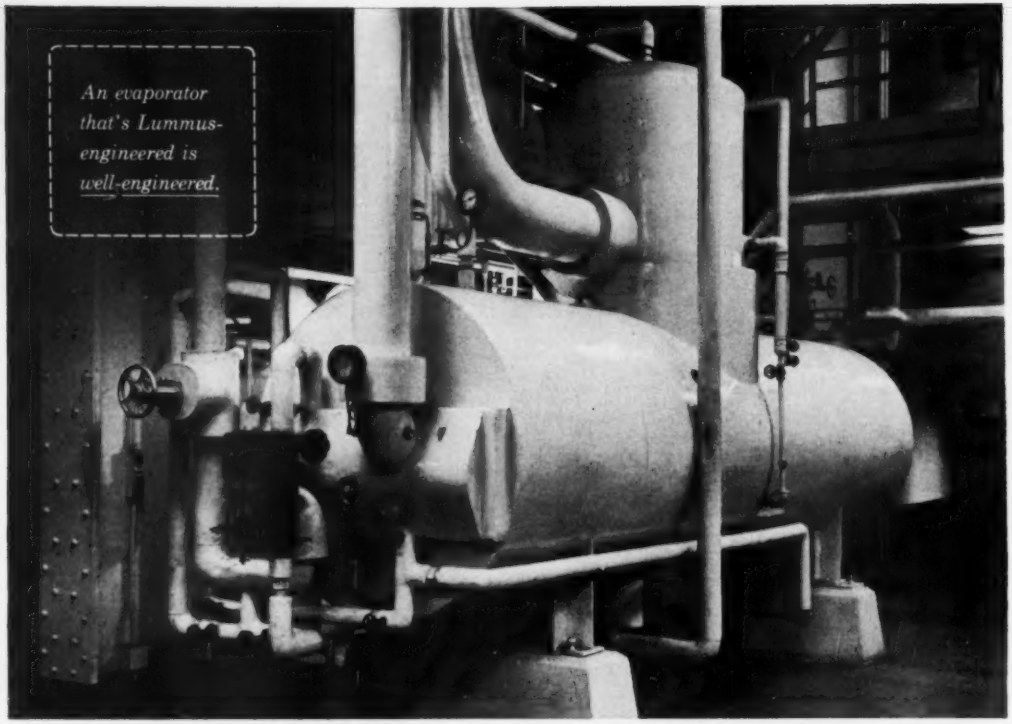
CMH

ONE DEPENDABLE SOURCE
for every flexible metal hose requirement

Convoluted and Corrugated Flexible Metal Hose in a Variety of Metals • Expansion Joints for Piping Systems
Stainless Steel and Brass Bellows • Flexible Metal Conduit and Armor • Assemblies of These Components



An evaporator story that waited 2 years to be told!

Translating requirements into equipment at the time an evaporator is built is one thing. Conducting a field test to check performance after the unit has been two years on the "firing line" is a horse of another color.

The Lummus Bubble Tray Evaporator at Rochester Gas and Electric's Russell Station—shown above—came through such a test with flying colors.

The test placed emphasis on precise determination of vapor purity on a gas-free basis. Results showed that vapor purity did not exceed 0.2 p.p.m. solids content with shell concentration at an average of 2800 p.p.m. for the test period. Of great significance is the fact that this extremely favorable purity remained stable at loads varying from 10% overcapacity down to 25% of design throughput.

This tells its own forceful story of why Lummus can guarantee evaporator performance of not more than 1.0 p.p.m. vapor purity with 3000 p.p.m. shell concentration. It also shows what's available in *plus-performance* when you look to Lummus for your heat exchanger requirements.

THE LUMMUS COMPANY

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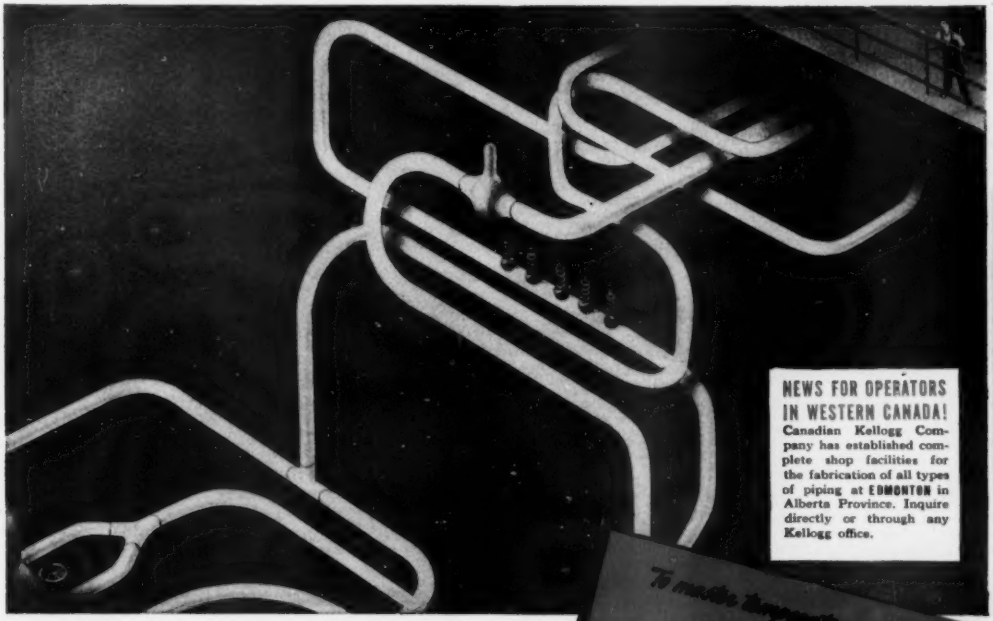
Note: Thirteen Major Reheat Units...

. . . within a short period, we have contracted to fabricate and install the critical power piping for thirteen major reheat units. These systems are for nine leading utility companies...include designs by six well-known consulting engineers...and have a total operating capacity of more than 1,150,000 kws. In addition, Kellogg power piping has been specified for many traditional-type installations in the U.S., Canada, Europe and South America.



NEWS FOR OPERATORS IN WESTERN CANADA!
Canadian Kellogg Company has established complete shop facilities for the fabrication of all types of piping at EDMONTON in Alberta Province. Inquire directly or through any Kellogg office.

To make temperature, pressure and chemicals mix

M. W. KELLOGG

piping and process equipment

Special studies of unusual problems such as graphitization to assure long life and low maintenance.

Metallurgical research by recognized specialists who have made major contributions in this field.

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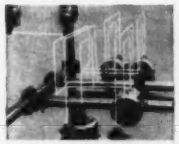

Exclusive Equipment for accurately analyzing stresses in piping and providing unique data for critical installations.

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Top welding performance in shops and in the field by welders accustomed to working under X-Ray checks.

Quality control, devised by metallurgical experts, embracing forming, heat treating and non-destructive testing.

Pressure Vessels
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"Fact Finder" shows at a glance:

Btu loss
Surface Temperature
Efficiency

FIND THE FACTS ABOUT

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WRITE FOR UNIBESTOS "Fact Finder" on your company's letterhead. It will be mailed to you without obligation.

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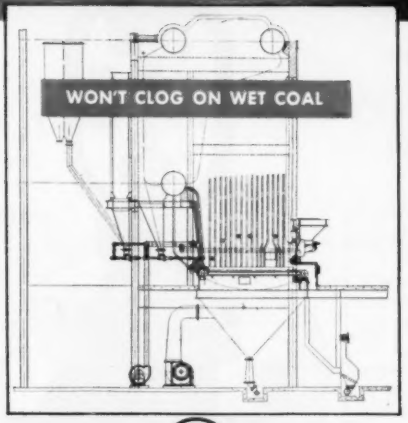
TOP EFFICIENCY FROM LOW AND HIGH ASH COALS

PERFECT SPREAD STOKER



Three AE Perfect Spread 2-feeder, travelling grate Stokers recently installed by a leading pharmaceutical manufacturer in the midwest. The boilers, each with a maximum continuous capacity of 60,000 lbs. per hour are Union "A" Type. Efficiency at normal capacity, 83.4%; at maximum capacity, 82.4%. Consulting Engineer, Austin Company.

In the Boiler Room illustrated, the Perfect Spread Stokers were guaranteed to use coal containing either 13,306 B.T.U. or 11,327 B.T.U. per lb. as fired. These two coals have moisture contents of 4.7% and 10.7%, with ash content of 8.2% and 10.1%, respectively. With either coal, practically the same capacity is available but these Perfect Spread Stokers have done even better than predicted. Five different grades of coal have been used to date . . . and all with top efficiency.

Perfect Spread's unique feeder won't clog on wet coal but feeds uniformly—not in slugs—regardless of moisture content. Its engineered cinder return and adjustable overfire air system give comparable results from either low or high ash coals. Its even feed characteristic insures higher CO_2, freedom from smoke puffs, minimum carbon in the ashpit, and less fly ash. Feeders adjustable from 50 to 7,500 lbs. of coal per hour . . . capacities range from 8,000 to 500,000 lbs. of steam per hour. Mail coupon today for full data.

AMERICAN ENGINEERING COMPANY

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AE Products are: Taylor and Perfect Spread Stokers, Marine Deck Auxiliaries, Hele-Shaw and Hydramite Fluid Power, Lo-Hed Hoists, Lo-Hed Car Pullers

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Gentlemen: We are interested in saving fuel dollars. Kindly send booklet giving full information about Perfect Spread Stokers.

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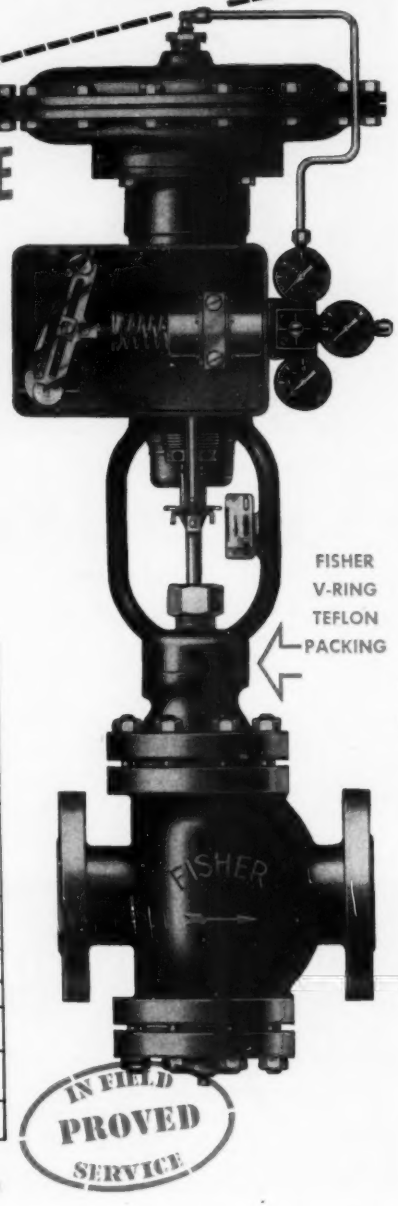
FOR ACCURATE POSITIVE VALVE POSITIONING



Features

- COMPACT — SIMPLE RUGGED
- 2 YEARS FIELD SERVICE
- EASILY ADJUSTABLE
- FORCE BALANCE TYPE OF POSITIONER
- AVAILABLE WITH OR WITHOUT BY-PASS
- USABLE AS REMOTE POSITION INDICATOR
- FOR DIRECT OR REVERSE ACTION VALVES

Technical Data

TEST			FISHER TYPE 3500
INSTRUMENT PRESSURE SENSITIVITY CONTROLLING PRESSURE CHANGE NEEDED TO PRODUCE 2 LBS. TO 15 LBS. TO DIAPHRAGM			0.07 LB.
STEM MOVEMENT SENSITIVITY AMOUNT STEM CHANGE TO PRODUCE 2 LBS. TO 15 LBS. TO DIAPHRAGM	½" TRAVEL		0.0037" AVE.
	2" TRAVEL		0.015" AVE.
SPEED TIME IN SECONDS FOR FULL TRAVEL	SIZE	TRAVEL	
	DD	¾"	1.2 — 1.2 SEC.
	FF	1½"	4.2 TO 4.8 SEC.
	GG	2"	7.2 SPC TO 9.6 SEC.
	HH	2"	10.5 TO 12.6 SEC.
LAG ERROR IN POSITION AT 9 LBS. CONTROLLER PRESSURE	½" TRAVEL		0.0006" AVE.
	2" TRAVEL		0.001" AVE.
EFFECT OF VARIATIONS IN AIR SUPPLY PRESSURE	½" TRAVEL		0.1 LB. PER 5 LB. CHANGE
	2" TRAVEL		0.1 LB. PER 5 LB. CHANGE
CHARACTERISTICS CONTROLLED P VS DIAPHRAGM P			LINEAR
COMMENTS			STABLE ADJUSTMENTS ALL EASY AND SIMPLE
AIR CONSUMPTION NORMAL 9 LBS. DIAPHRAGM PRESSURE			15.0 CU FT/HR

FOR COMPLETE DETAILS WRITE FOR BULLETIN E-3500.

Fisher Governor Co., Marshalltown, Iowa

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A big addition to the still new MARSH PLANT

25% more service-for-you space —

Three basic groups of Marsh Gauges are illustrated: the "Standard," "Quality," and Mastergauge groups. While there is considerable difference in design and construction (and therefore in price) each series contains the *best gauges of their kind.* Write for a new Marsh Catalog covering your specific needs.

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Such swift expansion is no mere happenstance. Long before we built our Skokie plant we had planned it down to the last detail to give new scope to the production principles that have enabled Marsh products to set their own standards . . . for quality . . . for downright *value.*

How well we accomplished our objectives—how much we exceeded even our own expectations—is convincingly attested by the need for this big addition to keep pace with the ever-accelerating demand for Marsh instruments, heating specialties, and refrigeration equipment.

This increased manufacturing space will provide facilities to maintain Marsh quality standards while giving you Marsh products at a faster pace. It is 25% more service-for-you space.

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MARSH GAUGES

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915 pages, 6 x 9, hundreds of illustrations, $12.50, payable $3.50 in 10 days and $3.00 monthly

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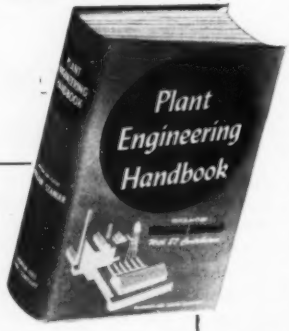
Compiled from some 450 major references, this handbook covers many new advances such as: latest information on synthetic fuels; the heat pump; gas turbines; spreader stokers; latest research in combustion and furnace and equipment design; package boilers, etc. The smoke and fine particles section is unusually complete, and in view of current interest in air pollution, very timely. The book contains a wealth of information for the experienced engineer, yet gives instructions for firing and operating equipment that the boiler room operator will understand. Comparative tables are included to show advantages and disadvantages, salient features, applications, performance, and characteristics of optional equipment or methods



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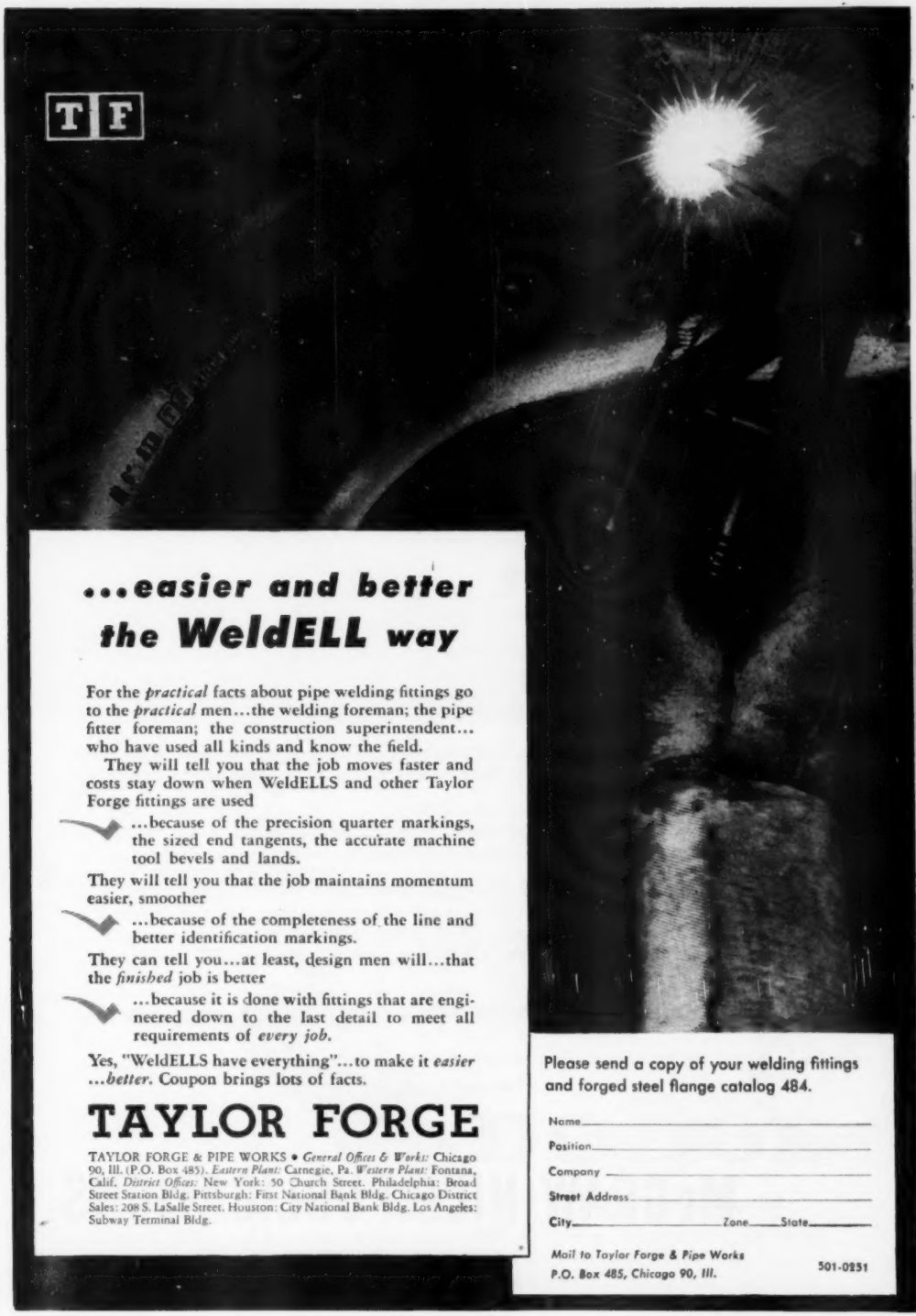

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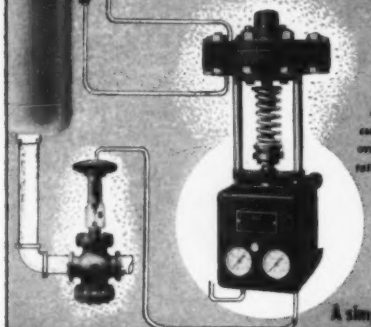

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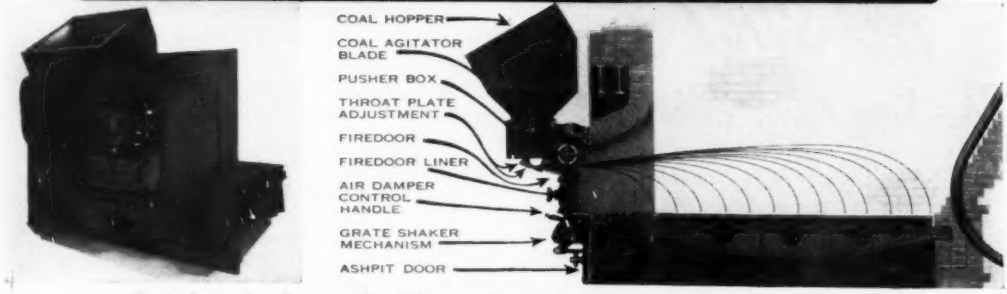

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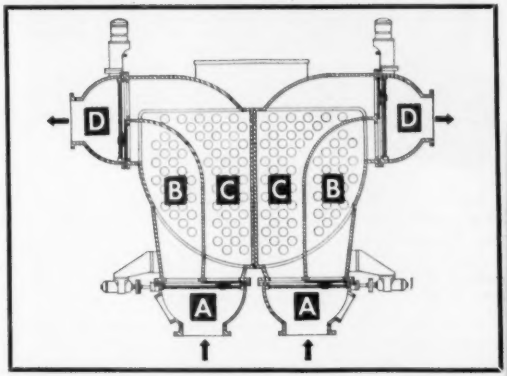

CROSS-SECTION DUAL BANK CONDENSER SHOWING HOW "REVERSE FLOW" WORKS

Both halves work the same but independently of each other.

Left Side: Water enters divided water box at valve chamber A, with left port open. It flows through pass B to end of condenser, back through pass C and out through upper port of D.

Right Side: Flow is reversed: Valves at inlet A and discharge D are changed to permit water to flow through C and back through B in the opposite direction, then out through lower port of D.

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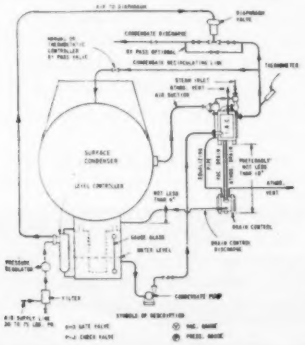
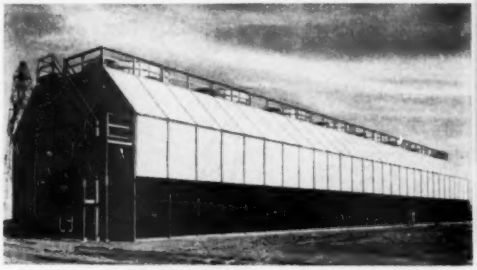
This diagram is typical of the information awaiting you in Specification 88. This 4-page illustrated bulletin describes the improved steel shell Tubejet Air Ejectors with combined surface type inter-after condenser. Many power plant engineers are adopting this more reliable, space saving equipment for stationary power plant use. A request on your company letterhead will bring a copy of Specification 88 by return mail.





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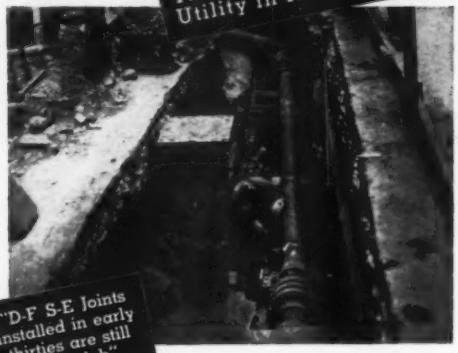

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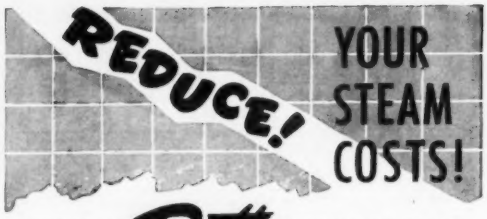

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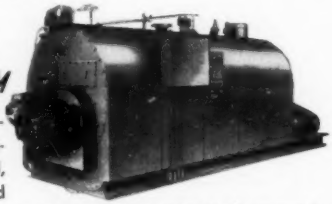

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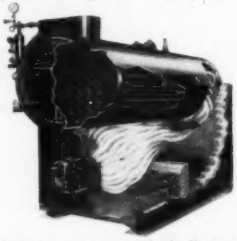

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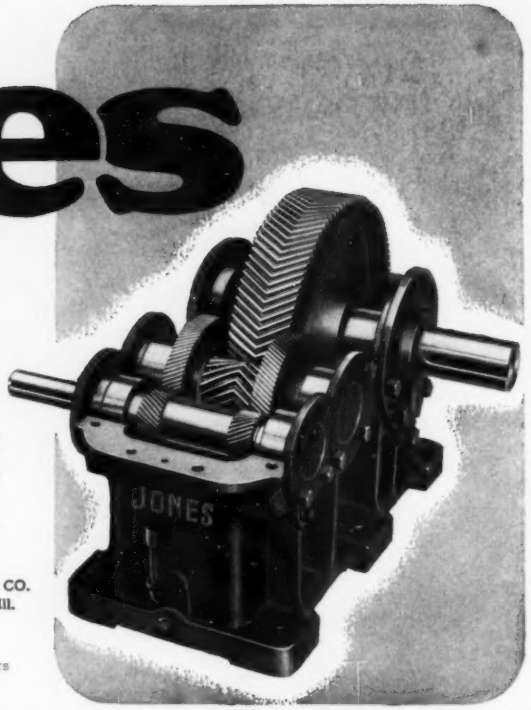

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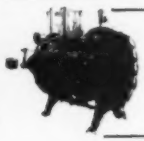

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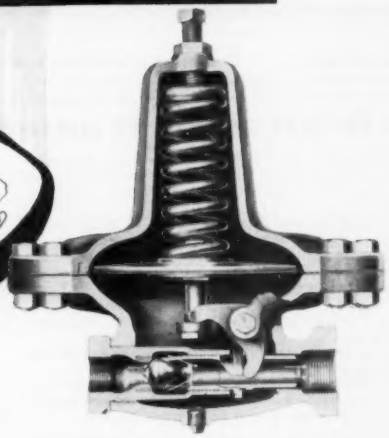

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BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES
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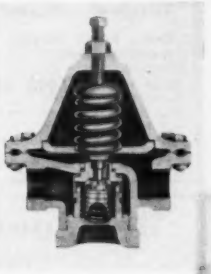
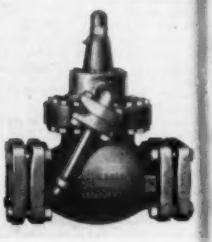
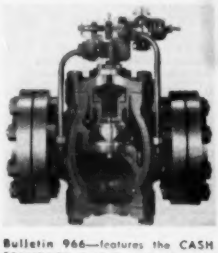


Bulletin 950—features the CASH STANDARD Type D Single Seat Pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.



Bulletin 956—features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



Bulletin 966—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air; with any gas or oil that is non-corrosive; and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.

ENGINEERS

Electrical Mechanical Structural

Openings in Ohio and New York offices offering long term employment with good salary for qualified Group Leaders, Designers and Draftsmen experienced in one or more of the following phases of industrial plant design:

Electrical Power, lighting layouts and electrical controls.

Mechanical Plant layout, process piping, conveyors, heating and ventilation, boiler houses, process equipment layout, refrigeration, plumbing, tanks and vessels, packaging equipment, special machinery and equipment.

Structural Structural steel and reinforced concrete.

Please submit complete resume stating experience, education, salary required and availability date.

THE H. K. FERGUSON COMPANY

Engineers and Builders

The Ferguson Building

1783 E. 11th St., Cleveland 14, Ohio 19 Rector St., New York 6, N. Y.

Designer-Draftsman Wanted

by long established Engineering firm for work in North Carolina office specializing in Public Works Projects including Steam-Electric Power Plants, Water Purification Plants, Sewage Treatment Plants and other Public Works Projects:

(a) **One (1) Architectural Engineer** capable of design, layout and production of working plans and specifications and assuming, in addition, supervision of designing and drafting personnel.

(b) **Two (2) Designer-Draftsmen** for Steam-Electric Power Plant design and preparation of working plans for general and detailed layout including structures, equipment and piping.

(c) **Two (2) as per (b)** except for work on Water and Sewage Treatment Plants.

(d) **Two (2) Draftsmen** capable of rapid preparation of completed working drawings from designs by others. Draftsmanship and lettering must be neat and accurate.

Salary open. Furnish complete experience data, samples of workmanship, recent photograph, references, earliest date could report for work, with reply. Only maturely experienced men wanted.

P-8343, POWER 330 W. 42nd St., New York 18, N. Y.

REPLIES (Box No.):
Address to office nearest you
NEW YORK: 330 W. 42 St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

MECHANICAL ENGINEER with 10 to 15 years experience in operating and office work for employment in the engineering of power and utility facilities for a large industrial plant in the Gulf Coast area. This is not a temporary construction position. P-8276, Power.

WANTED—GRADUATE Mechanical Engineer—Age 30-40, Experienced in Steam power plant operation and betterment. Location New York City, involving part time traveling in South America. P-8698, Power.

WANTED: EXPERIENCED Power Plant Superintendent with paper mill experience for large mill in South. Initiative and capable handler of men are primary qualifications. Age preferences 38 to 50. Contact by writing P-8674, Power.

WANTED: GENERAL Manager for proposed $20,000,000.00 power generation and transmission cooperative in Kentucky. Required: Successful record of executive accomplishment, understanding of engineering, utility and cooperative fields desirable, but principle requirement is demonstrated capacity to apply top management skills. Include in application: Employment record and references. All applications must be received by February 28, 1951. Apply to Box 82, Winchester, Kentucky.

MECHANICAL ENGINEER: Permanent position with excellent opportunity. Experience in design of industrial water conditioning equipment and power plant accessories is required. Write giving detailed information on education and experience to P-8706, Power, Location Philadelphia, Pennsylvania.

SELLING OPPORTUNITIES OFFERED

OPPORTUNITIES OPEN for sales representative with a large national manufacturer of power plant feedwater treatment and allied chemical lines for industrial plants. Established territories open. Mechanical or Chemical Engineering degree from accredited college or university required. Under 35 years of age, three years' experience in sales, engineering, production or related fields. Write fully, giving business history and salary requirements. All replies confidential. RW-8261, Power.

FOR MEN looking for a sales future. Opportunities open for sales representatives with a large national manufacturer of power plant feedwater treatment and allied chemical lines for industrial plants. Established territories open. Mechanical or Chemical Engineering degree for accredited college or university required. Under 35 years of age, three years' experience in sales, engineering, production or related fields. Write fully, giving business history and salary requirements. All replies confidential. RW-8605, Power.

SALES MANAGER. Nationally known manufacturer of heavy duty rotary pump desires sales manager with technical experience, preferably with pump application work for power plant, refinery and chemical industries. Must devote most of his time traveling throughout the United States calling on sales representatives. Please specify educational qualifications, age, RW 8557,) Power.

ATOMIC POWER

WESTINGHOUSE ELECTRIC CORPORATION

IMMEDIATE OPENINGS

For experienced senior and junior engineers

- Servomechanism designer experienced in gear trains, bearing applications, differentials, etc.
- Mechanical engineer, materials experience in wear, corrosion, etc.
- Application or design engineer experienced on hydraulics (pumps, hydraulic motors, flow, calculations).
- Process control engineer, capable of making system study of hydraulic circuits, valves, etc.
- Engineer, experienced in aircraft hydraulic control, remote indication, etc.
- Mechanical designers of complete systems in the instrument servo range.
- Process control engineer to design complete servosystems involving all auxiliary apparatus and all controls.

For application write

Mgr., TECHNICAL EMPLOYMENT

306 Fourth Ave., Pittsburgh 30, Pa.

EMPLOYMENT SERVICES

SALARIED POSITIONS $3,500 to $35,000. We offer the original personal employment service (established 41 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered; present position protected. Ask for particulars. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL $3,000-$25,000. This confidential service established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G. 241 Orange St., New Haven, Conn.

POSITIONS WANTED

EXECUTIVE MECHANICAL Engineer—Twenty years experience in design of mechanical features of central station and industrial power plants and process systems. Thoroughly familiar with public utility operation and planning. Desires connection with progressive firm in executive capacity. Graduate registered professional engineer, member N.S.P.E. and A.S.M.E. Excellent health, age 42, prefer location on Eastern seaboard. PW-8622, Power.

POWER PLANT Operator, age 29 with eight yrs. experience in modern power plant operation and maintenance, also some refrigeration. Technical school graduate. PW-8515, Power.

ASSISTANT WORKS Manager—Engineer. Experienced plant layouts, mechanical-structural design, piping, extensive underground utilities, material-handling, development production equipment, in metal-working, foundry, furnace, high-temperature processing and steam plants, analysis operations, costs, statistical reports; $9,000. PW-8665, Power.

(Continued on the opposite page)

Additional Positions Vacant Advertising on the opposite page

POSITIONS WANTED

ASSN. CHIEF Engineer—Eight years experience in operation and maintenance of turbines, refrigeration and coal, gas and oil fired boilers. Chief License. Age 27, married. PW-8714, Power.

BUSINESS OPPORTUNITY

Wanted to buy.

Power company of about 200 KW of installed capacity. BO-8308, Power.

WANTED

ANYTHING within reason that is wanted in the field served by Power can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

OFFICIAL PROPOSALS

Aswan Dam
Hydro Electric Scheme

EGYPTIAN GOVERNMENT
MINISTRY OF PUBLIC WORKS
HYDRO-ELECTRIC POWER COMMISSION

GENERAL ADJUDICATION FOR CIVIL ENGINEERING, BUILDINGS, PENSTOCKS, AND OTHER WORKS

Further to the earlier announcement of The Egyptian Government on the 10th November 1950 that Tenders are invited for the supply, erection and maintenance of the Civil Engineering, Buildings, Penstocks and Other Works required for the construction of a Hydro-Electric Power Station at the Aswan Dam, all according to the Specification.

The Egyptian Government hereby announces that the Tender Documents comprising Conditions of Contract, Specification and Tender Drawings for the entire works may be obtained either at the Hydro-Electric Power Department, Ministry of Public Works, Cairo, or the office of the Consulting Engineers of the Egyptian Government, Kennedy & Donkin, 12, Caxton Street, London S.W.1., or from Royal Egyptian Embassies and Legations in Washington, Paris, Stockholm, Berne, Brussels and Rome as from 10th January 1951.

Tenderers must pay L.E. 50 (Fifty Egyptian Pounds) which covers the cost of the complete set of Tender Documents and Drawings. This sum must be paid to the National Bank of Egypt in London to the credit of Hydro-Electric Power Department, Ministry of Public Works, in the case of purchase of the Specifications from the Consulting Engineers, Kennedy & Donkin, and will not be refunded.

Upon presentation of the Bank receipt to the Consulting Engineers in London or on the payment of the required sum at the Hydro Electric Power Department, Ministry of Public Works or at one of the above mentioned Embassies and Legations, as the case may be, tenderers will be supplied with the complete set of Tender Documents above referred to. Also such sums will not be refunded.

Firms who have already purchased the Tender Documents for the original Civil Enquiry which was subsequently cancelled and who have not applied for a refund of the sums previously paid, will be able to exchange the original Documents for the new Specifications without further charge.

When submitting their tenders, tenderers must pay a provisional deposit of two per cent of the value of the Contract with a maximum of L.E. 100,000 (One hundred thousand Egyptian Pounds) to the National Bank of Egypt in Cairo or in London to the credit of Hydro-Electric Power Department, Ministry of Public Works. Letters of Guarantee from approved Banks will be accepted in lieu of cash. A list of approved banks is given in the Specification.

CHIEF STATIONARY ENGINEER REQUIRED FOR MONTREAL EAST OIL REFINERY

To take charge of modern steam plant and associated equipment. Should be thoroughly experienced in steam plant operation and maintenance, capable of directing staff and co-operating with engineering personnel. Applicants now holding Province of Quebec Chief Stationary Engineman's Certificate Grade AB preferred, but applications will also be considered from those holding 2nd Class Grade AB certificates and others who feel they could qualify for this position. Salary open. Applications will be held strictly confidential and should give full details as to personal and occupational qualifications.

P8529 POWER
330 W. 42 St., New York 18, N. Y.

STEAM ENGINEERS with electrical experience to train as Inspectors of Boilers and machinery for large Insurance Company. Minimum Requirements: Age 30 years; Education, High School; Experience, 5 years operation and maintenance. Normal starting salary with security, employee benefits, and promotion on merit. Reply stating age, experience, education.

P-7813, Power, 330 W. 42 St., N. Y. 18

New England Boiler Setting Co.
Specialists on
FIRE BRICK CONSTRUCTION
Industrial Furnaces
Expert Repairing
Stephen S. Donoghue
106 Webster St. Arlington 74, Mass.

Graduate ENGINEERS

GOOD OPPORTUNITIES FOR

INSTRUMENTATION ENGINEERS: Five or more years of progressively difficult experience in Instrument Research Development or Design. Must have broad and thorough knowledge of instrument theory and application. Should have some knowledge of Chemical Equipment and its operation. Must be graduate.

POWER ENGINEERS: Must have five to fifteen years' experience in some of the following: operating, testing and maintaining power plant equipment, supervising power plant operations, making cost and evaluation studies, heat balance work, power cost accounting, design and layout of power plants, and the selection and installation of power equipment. Must be graduate.

AIR CONDITIONING ENGINEERS: At least 7 years' experience in selection and operation of heating, air-conditioning, ventilating and refrigeration equipment. Well versed in the theory of thermodynamics, fluid flow and heat transfer. For consulting evaluation, and economic operation services. Must be graduate.

HEATING AND VENTILATION ENGINEERS: Eight to ten years progressively difficult experience in field and office problems in heating, ventilating and air-conditioning design. Also, experience in making economical evaluation of alternate methods. Must be graduate.

ELECTRICAL ENGINEERS: Must have eight to twelve years' broad and thorough experience in electrical design and operating problems of industrial plants with thorough knowledge of selection, installation, economical operation and maintenance of electrical equipment. Must be graduate.

MECHANICAL IMPROVEMENT ENGINEERS: Five or more years' experience in Machine Design and Development. Mechanical Improvement work involving Stress Analysis, Lubrications, Vibrations and Fluid Dynamics with Mechanical Equipment such as Pumps, Compressors, Agitators, Bearings, Drives, etc. Must be able to apply higher mathematics in solution of mechanical problems. For consultation and evaluation work.

MAINTENANCE ENGINEERS: Five to ten years in planning maintenance work, establishing manpower and material requirements, scheduling and controlling work. Must be thoroughly familiar with Machine and Hand Tools used in Plant Maintenance Work. Must have supervised persons doing maintenance work. Must be graduate. For consultation work.

Give experience, education, age, references, personal history, salary received and salary expected. Please be complete and specific.

ALL INQUIRIES WILL BE CONSIDERED PROMPTLY AND KEPT CONFIDENTIAL.

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Engineering Department Personnel
WILMINGTON 98, DELAWARE

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DISMANTLING & MOVING CONTRACTORS

Unloading—Moving—Erection
Of Heavy Equipment
Our Specialty

Fully Equipped & Insured
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(Anywhere in Middle West)

ALSO INTERESTED IN BUYING
OBSOLETE HEAVY EQUIPMENT
"AS IS" "WHERE IS"

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610 CLEAVELAND BLDG. ROCK ISLAND, ILLINOIS

WAGNER
CERTIFIED REBUILT

ELECTRIC MOTORS & GENERATORS
Backed by 45 Years of Quality & Service

M-G SETS

KW	Mfr	Input V	Output V
300	G.E.*	440 AC	275 DC
300	Ridgeway*	2300 AC	250 DC
200	Whse*	2300 AC	275 DC
200	Gen. Elec.*	220/440 AC	125 DC
200	Reliance	2300/440 AC	250 DC
150	Gen. Elec.*	2300 AC	550 DC
150	Burke*	550/440 AC	250 AC
105	Century b.b.	220/440 AC	70 DC
100	Delco (3)	220/440 AC	125/250 DC
100	Allis Ch.* (2)	2300/440 AC	60 DC
100	Delco b.b.*	2300/440 AC	125/250 DC
100	Gen. Elec.	220/440 AC	125 DC
75	Gen. Elec. (3)	220/440 AC	125 DC
75	Star* b.b. NEW	220/440 AC	250 DC
65	Whse.	220/440 AC	250 DC
60	Gen. Elec.*	220/440 AC	60 DC
50	Gen. Elec.	220/440 AC	250 DC
45	Cr. Wh. b.b. (2)	220/440 AC	125 DC
40	Whse. (3)	220/440 AC	125 DC
40	N.W. conv.	220 AC	230 DC
40	G.E.	220/440 AC	250 DC
35	Cr. Wh. b.b. (3)	220/440 AC	125 DC
35	G.E.	220/440 AC	48 DC

*Syn. motor drive.

D. C. MOTORS

HP	Mfr	Type	Volts	Speed
200	Reliance	1970T	230	575/750
100	Whse.	SK181	230	450/900
100	Gen. Elec.	C	230	575/1000
75	Gen. Elec.	BC 36	550	850
75	Gen. Elec.	RC	230	1000
75	Allis Ch.	E-149	230	500
75	Northw'n	K20	230	1750
75	Century NEW	DN	230	850
60	Gen. Elec.	RC 38	230	425/850
60	Cr. Wh.	50H	230	700
60	Reliance b.b.	651T	230	750
60	Gen. Elec.	CD112	230	1150
50	Whse.	SK	230	1750
50	Gen. Elec.	B.C. 14	250	1850
40/60	Whse.	SK160	230	500/1000
40	Gen. Elec.	BC 32	230	1150
40	Cr. Wheeler	EH	230	1750
40	Whse.	SK110L	230	1750
40	Whse. (3)	SK130	230	850
35/50	Gen. Elec.	CD123	230	575/1150
30	Whse.	SK110L	230	1150
25	G.E. b.b.	CD93	230	1150

- EXPLOSION PROOF MOTORS—
- GEARHEAD MOTORS, AC & DC.
- FREQUENCY CHANGERS.
- CIRCUIT BREAKERS, AC & DC.
- SPEED REDUCERS

D. C. GENERATORS

HP	Mfr	Type	Volts	Speed
300	Gen. Elec. 1 brg.	DMC	275	720
200	Reliance	1970T	250	720
105	Century b.b.	1500 amp	70	1200
100	Gen. Elec.	C	250	750
100	Gen. Elec.	DLC	125/250	675
75	Gen. Elec.	BC	250	1200
75	Gen. Elec.	BC	600	1200
75	Allis Ch.	E	250	750
75	Gen. Elec.	RC36	125	1200
65	Whse.	SK160	250	1100
60	Gen. Elec.	BC	250	575
60	Gen. Elec.	CD	250	1450
50	Allis Ch. (2)	EW	125/250	1200
50	Gen. Elec.	B.C. 14	250	1200
50	Cr. Wheeler	50H	250	900
45	Cr. Wh. b.b.	FH	125	1750
40	Whse.	SK	250	1200
35	Cr. Wh. b.b.	EH	125	1750

A. C. MOTORS—25 CYCLE

HP	Mfr	Type	Volts	Speed
150	Whse.	HF	440	500
60	Allis Ch.	ARY	440	1500
60	Gen. Elec. Ind.	MTC5337	440	750
50	Gen. Elec.	I-K	440	750
50	Gen. Elec.	KT339	440	1500

A. C. GENERATORS—60 CYCLE

KVA	Mfr	Type	Volts	Speed
625	Gen. Elec.	ATB	2300	450
625	G.E. 25 cycle	ATB	2300	750
500	Allis Ch.	3 brg.	240/480	360
300	Gen. Elec.	ATB	600	720
275	G.E. 25 cycle	ATI	450	750
250	Whse.	G	2400/480	600
225	Gen. Elec.	ATB	240/480	600
187	Gen. Elec.	ATB	240/480	900
156	Elec. Machy.	3 brg.	240/480	514
150	Gen. Elec.	ATB	240/480	900
125	Gen. Elec.	ATB	240/480	720
125	Gen. Elec.	ATB	240/480	300
100	El. Machy.	RB.	2400	900
75	G.E. b.b.	ATI	240/480	1200

A. C. MOTORS—SLIP RING
3 Phase 60 Cycle 220 or 440 Volts

Qu	HP	Mfr	Type	Speed
1—	600	Gen. Elec.	I-M	360
2—	500	G.E. New 2300V.	MS74Y	900
1—	500	G.E. 3 brg.	I-M	450
1—	400	Gen. Elec.	IM	450
1—	450	Gen. El. 2200V.	I-P	1200
1—	300	G.E. 2200V.	I-M	450
2—	300	Allis Ch. 2200V.	ANY	720
1—	300	Gen. Elec. 2200V.	I-M	1800
1—	300	G.E. b.b. New	MS66	900
1—	250	Allis Ch. 2200V.	ANY	514
1—	200	Gen. Elec. 2200V.	I-M 17A	450
1—	200	G.E. 2200V.	I-M-16	600
1—	200	Gen. Elec.	I-M	360
1—	150	Gen. Elec. 2200V.	I-M-16	600
1—	150	G.E. 2200/4000V.	I-M	1200
1—	150	Gen. Elec.	I-M-17	450
1—	125	Gen. Elec.	I-M-15	720
2—	100	Gen. Elec.	I-M	1800
1—	100	G.E. Vertical	MT553	1200
3—	100	Gen. Elec.	IM-15A	514
1—	100	Northwestern	HWT5A	900
1—	100	Gen. Elec.	I-M	720
1—	100	Cr. Wheeler	9H	600
1—	75	Gen. Elec.	I-M-E13	1200
1—	75	Gen. Elec.	MT552	900
1—	75	Gen. Elec.	I-M-14	720
1—	75	Gen. Elec.	MT558	600
1—	75	G.E. 2200V.	MT556	720
1—	75	Gen. Elec.	MT557	1800
1—	75	Whse. 2200V.	CW	600
1—	60	Fair. Morse	BV	720
1—	60	Whse. 2200V.	CWT61C	900
1—	50	Allis Ch.	ANY	900
1—	50	Howell	SR437	1200
1—	50	Gen. Elec. Ins.	ITC5013	600
1—	50	Gen. Elec.	I-M	720
1—	50	Gen. Elec.	MT556	1200
2—	40	Whse.	CW636A	1200

A. C. MOTORS—SYNCHRONOUS

HP	Mfr	Type	Volts	Speed
600	Gen. Elec. (2)	TS	2200	514
300	Whse.	G	2300/440	600
300	Gen. Elec.	ATI	440	720
250	Gen. Elec. (2)	TS	220/440	360
250	G.E. 3 brg. .8PF	ATI	220/440	600
200	G.E.	TS	220/440	150
200	G.E. 8PF	ATI	220/440	900
190	El. Machy.	3 brg.	220/440	514
150	Gen. Elec.	ATI	220/440	300
100	American b.b.	YGH	220/440	900
125	El. Machy. (2)	R.B.	2400/4800	900

A. C. MOTORS—SQUIRREL CAGE
3 Phase 60 Cycle 220 or 440 Volts

Qu	HP	Mfr	Type	Speed
1—	325	Gen. Elec.	KT420	600
1—	300	Allis Ch. 2200V.	AN	720
1—	250	Gen. Elec.	FT349AZ	3600
1—	250	Gen. Elec.	FT540	3600
1—	200	Allis. Ch.	AN	1200
1—	200	Whse. b.b. NEW	C8875	1800
1—	150	Gen. Elec. TEFC b.b.	K4233S	1200
1—	150	Gen. Elec.	I-K-16	600
1—	150	Reliance b.b. NEW	B6085	1200
1—	150	Gen. Elec.	KF557	1200
1—	150	Gen. Elec. 2200V	IK-K13A	1800
1—	125	Con. 2200V. b.b.	SK	1800
1—	125	F.M. 2200V. vertical	UH-16D	1200
1—	100	Gen. Elec.	I-K	720
1—	100	Allis Ch. 2200V.	A8226	1200
1—	100	Rel. TEFC NEW	C5085	1200
1—	100	Gen. Elec. b.b. NEW	K5048	1800
2—	100	Reliance TEFC	C6085	900
1—	75	Fair. Morse b.b.	HJQ	600
1—	75	Reliance b.b. NEW	C6085	900
1—	75	Reliance TEFC NEW	C5084	1200
1—	75	Reliance b.b. NEW	C5083	1800
1—	75	Gen. Elec.	KT229Y	3600
2—	75	Reliance b.b. NEW	C505	1200
2—	75	Gen. Elec.	I-K-14	600
1—	75	L. Allis b.b. Spl.	FX505	1200
1—	60	G.E. 2200V.	KT533	1800
1—	60	G. E. hitorq	KG504	1200
2—	60	Reliance b.b. NEW	B504	1800
1—	60	Reliance TEFC NEW	C505	1200
2—	60	Reliance b.b. NEW	C504	1200
1—	60	Whse. H.T.	C8504	1800
1—	60	Wagner b.b.	RP444	3600
2—	50	Gen. Elec.	KT343	1200
1—	50	Gen. Elec.	KT555	450
1—	50	Gen. Elec.	KT536	450
2—	50	G.E. Vertical	KT546	720
1—	50	Whse.	CT52C	720
2—	50	Reliance b.b. New	CC504U	900
1—	50	L.A. 2200 V. Ex. p.f.	K5048	1800
3—	50	Gen. Elec.	KT536	1200
2—	50	Whse.	C8	1200
1—	50	G.E. NEW b.b. HT	KG405	1800
2—	50	Reliance b.b. NEW	C445	1200
1—	50	Whse. hislip	WL607	900
1—	50	Allis Ch. 2200V.	AR445	1800
3—	40	Gen. Elec.	KT542	720

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Send for Complete Stock Lists

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MOTOR GENERATOR SETS
1—500 KW G.E. Syn. 250 V. 900 RPM
1—300 KW G.E. Syn. 250 V. 1200 RPM
1—300 KW G.E. Syn. 600 V. 1200 RPM
2—200 KW G.E. Syn. 250 V. 1200 RPM
1—200 KW Elliott Syn. 125/250 V. 1200 RPM
1—100 KW G.E. Ind. 250 V. 1200 RPM

ROTARY CONVERTERS
1—500 KW G. E. Syn. 250 V. 1200 RPM HCC, 6 Ph. 60 Cy. Transformers
1—300 KW G.E. Syn. 250 V. 1200 RPM HCC, 6 Ph. 60 Cy. Transformers
1—150 KW G.E. Syn. 250 V. 1200 RPM HCC, 6 Ph. 60 Cy. Transformers

ARMATURES
1—500 KW G.E. 250 V. MPC Gen. 900 RPM
1—300 KW G.E. 600 V. HCC Conv. 1200 RPM

WALLACE E. KIRK COMPANY
502 Grant Bldg., Pittsburgh 19, Pa.

MOTOR GENERATOR SETS

FOUR (4)—75 KW, Century, DC Generators, 250/125 volts (3 wire), 1200 rpm, coupled to; Century squirrel cage, 3 phase, 60 cycle, 220 or 440 volt motors.

These are 4 bearing units, ball bearing, drip-proof construction, with DC panels.

EMPIRE ELECTRIC COMPANY, Inc.
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MAIN 4-5900

FOR SALE

MODERN 1000 KW Turbo-Generator

In Excellent Condition

Non-Condensing, Steel case 80# back pressure .8 P.F., 3 phase, 60 cycle, 4150/2300 volts, alternating current, complete with accessories, switchboard, oil circuit breaker, and direct connected exciter. Only operated alternately for six years. Ideal for Chemical, Rubber, Petroleum, Textile, Pulp and Paper, and Sugar Refining Industries.

NEWMAN & COMPANY, INC.
6101 Tacony St. Philadelphia 24, Pa.

FOR SALE

G. E. Elec. Induction Motor No. 5283051
Type MT 28-2500-257. Form E
Volts 6600. Cyc. 60-Amps. 202 H.P. 2500
Secondary volts 706. Secondary Amps. 1530
Speed, full load 253 RPM Phase 3
2500 H.P. continuous-40 degree C. Rise
G. E. Elec. Controls:
G. E. Liquid Reostat, Cat. No. 4990236. Size 204 Cr 9291.

H. P. GUION
Dredges
303 W. 42nd St. New York, N. Y.

STEEL STORAGE TANKS
2—1000 & 2—10,000 Bbl. New Vertical
6—74,000, 55,000 & 37,500 Bbl. Vert.
8—25,000 Gal. Cap. Horizontal
50—10,000 & 3—20,000 Gal. Horizontal
6—10,000 & 12,000 & 18,000 Gal. 3/4" Shell
16 New 15,000 & 20,000 gal—9/16" Shell
L. M. STANHOPE, Rosemont, Penna.

LAND can help you meet your Production Schedule with

Guaranteed Electrical Equipment

1 YEAR GUARANTEE

1 to 50 HP
NEW and REBUILT
TEFC—EX. PR.—Drip proof and Splash proof
IN STOCK

SQUIRREL CAGE MOTORS
3 phase

H.P.	Make	Type	Speed
450	G.E. (vert.)	KF-6338	1180
250	L.-A.	137S	1150
200	G.E.	KT557	1760
200	G.E.	KF-6335	880
150	West.	CS	580
150	G.E.	IK	870
100	Wagner (NEW)	XP	1150
100	G.E.	K-544	1175
100	West.	CS	870
100	Al.Ch.		580
75	West. (2)	CS-654C	1750
75	Cont.	B.B.	1750
75	G.E. (3)	K-505	1175
75	G.E.	IK	900
75	G.E. (3)	KT-352	865
75	West.	CS	720
75	G.E.	KT 558	580
60	F-M	XP	1750
60	Howell	SCR	1800
60	Century		1150
60	West. (2)	CS-607	880
60	Rel. (2)	AA	875
60	G.E.	KT-346	865
60	G.E.	TEFC(GH)	427
50	G.E.	FTR-523	3600
50	Elliott	196	3450
50	West.	CS	1740
50	L. A.	XP	1150
50	West.	XP	1150
50	G.E.	KF-445	1170
50	West.	CS-642C	1160
50	West. (3)	CS	870
50	G.E. (2)	IK	870
50	G.E.	FTR-542	870
50	West.	CS	690
40	G.E.	TEFC(GH)	561

SLIPRING MOTORS
3 phase

H.P.	Make	Type	Speed
600	Cr.Wh.	131AQ	507
500	G.E. (2)	IM	450
400	West.	CW1218	500
225	Wagner	25 cy.	710
200	G.E.	MTP-557	1800
200	G.E. (2)	IM	1170
150	Wagner	31VRN	900
100	Al.Ch.		690
75	West.	CW	1150
75	West.	CW	720
75	G.E.	MT556	720
75	G.E.	IM	690
60	West.	HF	850
60	Al.Ch.		690
50	G.E.	MT-536	1150
50	West.	CW	1150
50	L. A.	OGH	870
50	F-M	BV	600
50	Al.Ch.	ARY	575
50	G.E.	IM	490

SYNCHRONOUS MOTORS

H.P.	Make	Type	Speed
475	West.		720
300	G.E.	ATI	900
260	G.E.	TS	900
250	Ideal	SMN	360
200	Ideal	SMW	257
180	G.E.	ATI	900
150	G.E. (2)	TS	1200
150	G.E.	ATI	900
125	G.E.	ATI	900
135	West.	G	1200
135	Ideal		1200
100	Elec.Prods.		1200
55	El.Machry.	BRKT	1200

550 V.D.C. MOTORS

H.P.	Make	Type	Speed
765	G.E. (4)	MPC	1045/1350

230 V.D.C. MOTORS

H.P.	Make	Type	Speed
400	A-C		415
200	West.	SK210	575
150	G.E.	MPC	400
125	G.E.	RC-15	1750
100	Al.Ch.		1150
90/45	G.E.	RF-17	950/475
75	Sprague		1000/1500
75	G.E.	RC36	800
75	West. (2)	SK-180	475
75	Cr.Wh.	LT	480/670
75	Cr.Wh.	CMC	375/950
75	E-D	25S	450/1350
75	West. (3)	SK151	250/1000
60	West. (3)	SK-160	680
50	G.E.	RC-12	1750
45/90	G.E.	RF-17	475/1950
50	West. (3)	SK-160	565
50	G.E.	RF-17	250/1000
50	West.	SK	250/1000
40	West.	SK-103	1750
40	Century	DN-454	1740
40	G.E.	RC-31	1700
40	G.E.	RC-32	1100
40	G.E.	RC-34	750
40	G.E. (2)	CD-1441	400/1500
40	Cr.Wh.	CCM	700
40	Rel.	461T	400/1200
35	West.	SK	250/1000
35	West.	SK-120	1150
35	G.E.	RLC	440/800
30	G.E. (8)	CDM-85	2200
30	West.	SK	975
30	Cont.	D-103	850
30	G.E.	RC-33	775
30	West.	SA	500/1500
30	West. (2)	SK-143	575
25	G.E.	RC-15	1750
25	West.	SK-83	1750
25	G.E.	*CDM-77	1750
25	E.D.	10S	1500
25	Rel.	92T	1150
25	West.	SA	500/1500
25	West. (2)	SK-130	600
25	G.E.	RF-14	300/1200

115 V.D.C. MOTORS

H.P.	Make	Type	Speed
300	West.	SK	900
100	Cr.Wh.	CMC	900
40	G.E.	CD-113	850
30	West.	S	600
25	G.E. (2)	CD	1800
25	West.	SK-103	1150
25	Cr.Wh.	CCM	750
25	West.	SA	600/1200
15	E.D.	7½S	650/1230
15	Cr.Wh.	CM	650
10	Century	DN-334	1750
10	G.E. (2)	RC	1200
10	Al.Ch.		900
10	E.D.	7½S	425/1700

AC GENERATORS

KW	Make	Type	Speed
180	G.E.	ATB	900
100	G.E.	ATB	360
75	G.E. (2)	ATB	1200
50	F-M	GG	1200
15	G.E.	ASI	1200

AC GENERATORS
Driven by DC Motors

KVA	Make	D. C. Input	A. C. Output
62½	G.E.	230	240
50	Star	115	120
35	G.E.	230	220
31	Ideal	115	440
31	El. Machry.	230	440
18	G.E. (3)	230	120/240
10	Burke	115	120
7½	Hertner	115	440
6¼	G.E.	230	240
5	El.Spec.	115	110
1¼	Al. Ch.	230	110

600 V.D.C. GENERATORS

KW	Make	Speed
400	G. E. (4)	1200
325	G. E.	1200
100	West. SK	900
60	G. E.	1200
30	Burke	1750
20	Reliance	1150

600 V.D.C. BALANCER

200 KW, G.E., MPC, 1200 RPM

GENERATORS
250 V.D.C. Motor Driven

KW	Make	Speed
1000	G. E.	900
500	West.	1200
300	Elliott	1200
300	G. E. (3)	720
200	G. E.	1200
200	West. Roto-trol	1200
150	West.	900
100	Delco	1200
90	G. E.	600
100	G. E.	700
75	G. E.	1200
50	A. C.	1200
40	Rel.	1750
42	ABC (2)	1200
30	G. E.	1200
25	G. E.	1200

125 V.D.C. Motor Driven

KW	Make	Speed
150	West. (2)	1150
100	West. (2)	900
100	G. E.	1200
100	El. Machry.	1200
75	Cr. Wh.	1200
50	Sturt.	2800
50	West. (2)	1150
35	G. E.	1750
35	Ideal	1200
30	G. E.	1150
30	L. A.	1450
25	El. Machry.	1150

GENERATORS
Low Voltage D.C.

Amp.	Make	Voltage
5000	Chandeysson	19/38
125	Hobart (8)	7½
1500	Century	24
2000	G. E.	24V
100	G. E.	30
1000	G. E.	33
150	Watton	40
1000 (3)	Chandeysson	40
200	G. E.	42
1500	G. E.	50
1500	Century	60
1500	G. E.	60
1000	G. E.	75

FREQUENCY CHANGERS AND GENERATORS

Size	Make	Output Frequency
150 KW	G. E.	150 cy.
154 KVA	G. E.	150 cy.
50 KW	G. E.	120 cy.
40 KW	G. E.	100 cy.
30 KW	G. E.	90 cy.
15 KW	G. E.	408 cy.
10 KW	G. E.	200/700 cy.
7½ KW	G. E.	408 cy.
3 KW	G. E.	408 cy.

TRANSFORMERS

2—400 KVA Maloney Dry Auto—220 to 440 V. 3 ph.
1—300 KVA, Al. Ch. 3 ph. 4160V/230 V.
1—300 KVA. Pittsburgh, 3 ph. 4160V/230V Secondary.
60—Additional Oil and Insulated Dry-type Transformers in stock, not listed, down to 1 KVA.

STARTERS—A. C.

1—450 H.P. West. magnetic reduced voltage (550 V.) Synch.
1—250 H.P. C-H Bulletin No. 9589 4150V.
1—200 H.P. G.E. CR-7065, 440V.
3—150 H.P. G.E. CR-7061, 220V.
2—100 H.P. C-H 220 V. Synch.
40—C-H and A-B; 2 and 4 speed.

STARTERS—D. C.

1—400 H.P. 230V. West. magnetic.
150—New 230V. D.C. magnetic starters, from 5 H.P. to 75 H.P., C-H, G.E., etc.
40—New 7½ H.P. 230V. magnetic reversing.
1—300 H.P. West. 115V. magnetic.

TRAVELING CRANES

2 Ton Harnischfeger, 26' 8¼" Span

Partial List ONLY

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ELECTRICAL POWER EQUIPMENT

GET A-1 PERFORMANCE
SAVE ON PRICE

HERE'S A WIDE SELECTION FROM OUR GIANT STOCK

SQUIRREL CAGE MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or higher)

H.P.	Make	Type	Speed
750	*G.E.	WT	720
400	*G.E.	K (ExProof)	3600
400	*Al. Ch.	ARWW (SoPr)	900
350	*Al. Ch. (new)	ARW	3600
300	*Westg.	CS	3600
300	G.E.	IE	1200
300	Al. Ch.	AR	900
250	Westg.	CS	1800
250	L. Allis	146S	720
200	Al. Ch.	^RZ TEFC	1800
200	*G.E.	IE	1200
150	G.E.	IE	1800
150	Al. Ch.	AZ TEFC	1200
150	Westg.	CS950A	600
125	*Al. Ch.	AR226	1800
125	G.E. (new)	K6333	900
100	U.S.	CFU vert	1200
100	Burke	EM	1200
100	Westg.	CS	1200
100	G.E.	KT5588	720
75	Westg.	CS761	1800
75	G.E.	K585 (DpPr)	1200
75	*Westg.	CS vert	900
75	Ideal	A4359	720
75	Al. Ch.	AR	720
60	Westg.	CSW445 vt.	1200
60	G.E.	K504U	1200
60	Al. Ch.	AR	514
50	G.E.	KT527	1800
50	U.S.	SCV vert	1800
50	Westg.	CS504	1200
50*	G.E.	KT342	900
40	G.E.	KT323	3600
40	Westg.	CS445	1200
40	G.E.	KT336	900

Hundreds of Smaller Motors

AC SYNCHRONOUS GENERATORS

3 phase, 60 cycle, 220 or 440 volts (*2200 volts or higher)

K.W.	Make	Type	P.F.	Speed
1500	G.E.	ATI	.8	900
1000	*Westg.	SO1D	.8	900
725	*G.E.	ATI	.8	720
350	*Westg.		.8	300
250	*Al.Ch. (new)		.8	720
150	El. Mach.	EM	.8	720
112.5*	G.E.	ATB	.8	1200
112.5	G.E.	TS	.8	1200
110	Cr. Wh.	103	.8	900
100	G.E.	ATB	.8	900
60	*Fr. Morse	D	.8	300
60	Fr. Morse	B	.8	900
55	G.E.	ATB	.8	1200
50	G.E.	ATB	.8	1200
50	Westg.		.8	1200
50	Cr. Wh.	50S6	.8	1200
37.5	Al. Ch.	EA121	.8	1800
30	Roth	126RS	.8	1800

AC SYNCHRONOUS MOTORS

3 phase, 60 cycle, 220 or 440 volts (*2200 volts or higher)

H.P.	Make	Type	P.F.	Speed
750	*Westg.		.8	900
700	*G.E.	ATI	.8	720
450	El. Mach.	EM	1.0	240
320	*Al. Ch.	Dr. Pf.	1.0	720
250	*Al. Ch.	Dr. Pf.	.8	720
200	El. Mach.	Ped	1.0	450
150	El. Mach.		1.0	900
150	El. Mach.	EM	.8	720
125	G.E.	TS954B	1.0	1200
125	Cr. Wh.	103-B	1.0	900
100	G.E.	TS954B	.8	1200
100	Cr. Wh.	103B	.8	900
100	G.E.	ATB	.8	900
75	G.E.	ATB	1.0	900
60	G.E.	TS7536	1.0	1200
20	Fynn W.	15VRN		1200
15	Century	ARC365	1.0	1200
4	G.E.	AK (25 cy)		1500

MULTI-SPEED AC MOTORS

3 phase, 60 cycle, 220 or 440 volts

H.P.	Make	Speed
40/20	Lincoln	900/450
7½-2½	Reliance Vert	18/12/9/600
7	G.E.	1800/1200
6	G.E.	18/12/9/600
5-1½	G.E.	18/12/9/600
6	G.E.	1200/500
3½	G.E.	18/12/9/600
3	U.S.	1800/900
2	G.E.	18/12/9/600
2	U.S.	1800/900
1	G.E.	18/12/9/600
½	Wagner	1800/900

SLIP RING MOTORS

3 phase, 60 cycle, 220 or 440 volts (*2200 volts or higher)

H.P.	Make	Type	Speed
2000	*G.E.	MT30	240
1200	*Cr. Wh.		240
650	Westg.	HE	350
500	Westg.	CW	350
400	G.E.	IM	514
300	*G.E.	IM	1800
250	Westg.	CW32B	900
200	G.E.	IM	600
125	G.E.	M6333	900
125	G.E.	M6334	720
100	G.E.	IM	720
100	Westg.	CW	600
75	Star	CS00	900
60	Westg.	CW	900
50	Al. Ch.	ARY	1800
50	G.E.	IM	425
40	Westg.	CW644	900
40	Al. Ch.	ARY223	720
35	Fr. Morse	UAB	1800
30	Westg.	CW	1800
30	G.E.	MT332	1200
25	G.E.	IM	1200
25	Al. Ch.	ARY220	900
20	G.E.	MT312	1200
20	G.E.	IM	720
20	Westg.	CW644	600
15	L. Allis	ON326	1800
15	G.E.	IM	1200
15	Al. Ch.	ARY216	900
15	Ideal	AVE	900
10	Westg.	CW324	1800
7½	Kimble	HA284	1725

SLIP RING MOTORS

Crane and Hoist Type

3 60/220 or 440 volt

H.P.	Make	Type	Speed
75	Westg.	CI756A	600
37	G.E.	HITC TENV	600
30	G.E.	ITC5010	1200
25	Westg.	CI572	900
20	Westg.	CI570	900
15	G.E.	ITC5010	720
11	Westg.	CI464	900
9½	R & M	4254 TENV	1200
5	G.E.	MTC5180	1200
3	G.E.	MR254 TENV	1200
3	G.E.	MTC5160	1200
2½	G.E.	MTC5130	1200
2½	Star	AHS27	1200

TURBINE SPECIAL

312 KVA Crocker - Wheeler AC Generator 3-60/240/480 volt, d-c to

375 HP Worthington - Moore Turbine, Single Automatic, non-condensing, 425-2 PSI, 10-2 Exh., 100 F SH with Reduction Gear and Accessories.

TRANSFORMERS

3—2060 KVA Maloney, 1 phase 13,200 volts primary 2300/4160 v. secondary

5— 750 KVA Westg.—AIR, 3 ph. 13,800 v. primary 480 v. secondary

1— 750 KVA Westg.—AIR, 3 ph. 13,800 v. primary 2,300 v. secondary

3—250 KVA Allis-Chalmers, 1 ph. 34,500 v. primary 240/480 v. secondary

3—200 KVA Westg., 1 phase 2400/4160 v. primary 120/240/480 v. sec.

3—150 KVA Gen. Elec., 1 phase 33,000 v. primary 240/480 v. secondary

BALANCING SETS

4—36 K.W., 250 v., 270 A., new, Bogue, Type MC1, 125 v. gen. BB comp'd on fab. base, d-c

2—20 K.W., 250 v., 160 A., new, Crocker-Wheeler, Type 151, 125 v. gen. 3 pt. bearings, close-coupled

MOTOR GENERATOR SETS

K.W.	Make	A.C.	D.C.
500	G.E.	2300	250
450	G.E.	2300	250
400	Westg-GE	2300	250
300	Westg.	2300	230
200	Cr.Wh.	2300	125
150	G.E.	440	250
150	Al.Ch.	220	125
100	G.E.	440	250
75	Al.Ch.	440	250
75	Westg.	2300	110
60	Al.Ch.	2300	110
50	Westg.	220	110
40	Cr.Wh.	220	125
40	Al.Ch.	440	250
30	Cr.Wh.	220	125
25	G.E.	440	250
20	G.E.	440	250
20	G.E.	440	125
10	Cr.Wh.	220	125
10	G.E.	440	250

D.C. to A.C.

100	G.E.	230	250

LOW VOLTAGE M.G. SETS

Amps.	Make	A.C.	D.C.
1500	G.E.	2300	60
1000	Chand.	440	40
1000	G.E.	440	35

DIRECT CURRENT MOTORS 230 Volts

H.P.	Make	Type	Speed
375	Westg.	Ped	650
200	Westg.	SK210	800
200	Reliance	1970T	675
175	G.E.	ELC11	750
100	G.E.	RC34	2500
100	Al. Ch.	E152	575
40	G.E.	CQ2004	600
35	Cr. Wh.	CM351	700
35	Sprague	C	600
30	Westg.	SK120	975
30	Cr. Wh.	CGM	450
30	Westg.	SK93	1750
30	G.E.	RC31B	1150
25	Westg.	SK100L	1100
25	Westg.	SK	900
25	Al. Ch.	E	700
20	Westg.	SK83	1750
20	G.E.	RC	1150
20	Westg.	SK	900
20	G.E.	RC	800
20	G.E.	LC	575
20	G.E.	CQ1827	600
15	Cr. Wh.	BH	1750
15	Westg.	SK63	1750
15	G.E.	RC29	1150

D.C. VARIABLE SPEED MOTORS—230 Volts

H.P.	Make	Type	Speed
325	Westg.	QM	450/900
200	Westg.	SK	400/800
150	Westg.	SK	400/1200
125	Westg.	SK193	450/1000
100	Al. Ch.	E-182	575/1150
100	Westg.	SK	400/1100
100/100	G.E.	MPC	100/300
90	Cr. Wh.	CMC	225/550
75	Westg.	SK	350/450
75	Westg.	SK151	250/1000
60/60	Westg.	SK170	525/1150
60	National		250/1000
35	Westg.	SK143	500/1500
35	G.E.	C	300/900

CHICAGO ELECTRIC

CARRIES COMPLETE STOCKS OF:

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- D.C. MOTORS
- M.G. SETS
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- PUMPS
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First Source for 41 Years for Quality Electrical Equipment

CHICAGO *Electric Co.*

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TRANSFORMERS — FOR SALE

1 Phase 60 Cycle
Rebuilt and Guaranteed

3—1250 KVA—G.E. 13800 2400
3—1000 KVA—G.E. 13800 480
3—1250 KVA—G.E. 6900 480
3—1000 KVA—G.E. 4800 480
6— 500 KVA—West. 2400 240/480
9— 333 KVA—West. 6900 480
9— 333 KVA—West. 4800 480
9— 333 KVA—West. 2400 480
3— 200 KVA—G.E. 2400 480/240
3— 150 KVA—G.E. 2400 480/240
3— 100 KVA—G.E. 2400 480/240
3— 100 KVA — G.E. 6900/11950Y 460/230
3— 75 KVA—West. 4800/2400 460/230
3— 50 KVA—G.E. 4800/2400 460/230/115
3— 37½ KVA — G.E. 4800/2400 460/230/115

We also Solicit Your Inquiries for Special Transformers Including Furnace Transformers

BUFFALO TRANSFORMER CO.
1510 NIAGARA ST.
BUFFALO 13, N. Y.

DIESEL ELECTRIC POWER

1—1000 KW C-W (NEW), 4000/2300 Volts, 3/60, 720 RPM, w/F.M. Mod. 38D8-1/8.
3—750 KW, G.E. (NEW) 2400/480 volts, 3/60, 720 RPM, w/G.M. Mod. 12-567A
1—300 KW, Westgh. (NEW), 480 volts, 3/60 720 RPM, w/G.M. Mod. 8-268A.
1—610 KW, G.E., 500 V, D.C. 750 RPM, w/Cooper Bessemer, 950 HP, Mod. GSB-8.
3—300 KW, Westgh., 120/240 V, D.C., 3 wire, 400 RPM, w/Baldwin Mod. V.O.

Sundfelt Equipment Company, Inc.
220 Hudson Street Seattle 8, Wash.

TRANSFORMERS

4—500 KVA, G.E., 14850-16500 to 230-460 Volts, Form L, Type A.
4—833 KVA, G.E., 16500 to 460 Volts, Form VDHJ, Type H.
3—333 KVA, Allis Chalmers, 44,000-220/440

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MODERN AIR COMPRESSORS

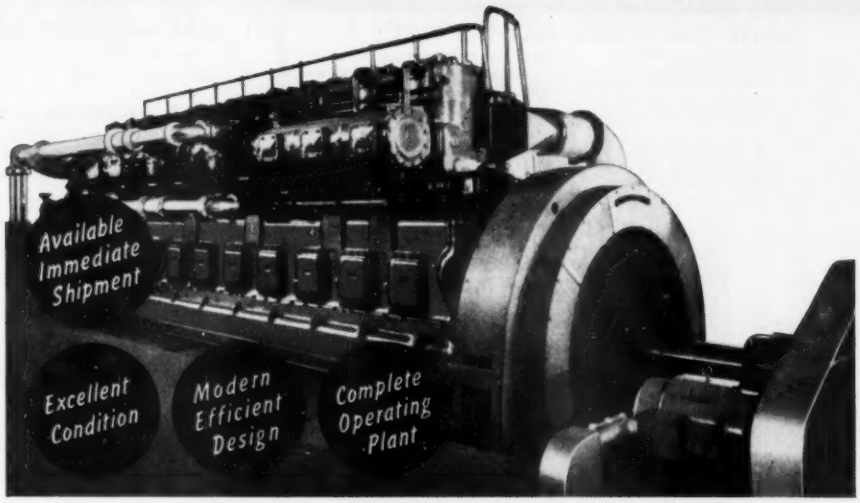
6040 Ft. INGERSOLL RAND 60 LB. ELECTRIC.
1—3865 A. 1—4488 Ft. NEW CHICAGO PNEU. OCE. ELEC. 125 LB. W MOTOR TO SUIT.
676 Ft. INGERSOLL RAND BELTED
1579 Ft. CHGO. PNEU. DIESEL. 125 LB.
1302 Ft. INGERSOLL RAND PRE-2 ELECTRIC. 100 LB.
1090 Ft. SULLIVAN WN114 175 HP 2200 VOLT NEW 1948

DARIEN, 60 E. 42nd St., New York 17, N.Y.

FOR SALE

Gantry-bridge coal crane, 1-yd. bkt., 75'x35'x140'. Stationary bridge coal crane, 1-yd., unequal legs. Cooper-Bessemer 1000 HP diesel engines (2), new. Diesel electric generator sets (5), 100 to 1250 HP. Locomotive cranes, gas, steam, 30, 25 tons, std. ga. Locomotives, diesel, gas, steam, 7 to 65 tons. Cranes, crawler and gantry types (7), diesel, elec. Rotary dryers, coolers, kilns (6). H. Y. SMITH CO., 828 N. B'way, Milw. 2, Wis.

POWER PLANT MACHINERY



1675 KVA Fairbanks-Morse Diesel Generator Unit

1250 KW 80% P.F. 1675 KVA 50° Fairbanks-Morse alternating current generator 3 phase 60 cycle 2400/600/480 volts, 300 RPM direct connected to

1750 HP Fairbanks-Morse Diesel Engine, 2 cycle, 10 cylinders, Model 33E16, 300 RPM.

The above unit is complete with direct connected exciter, switchgear, starting equipment, heat exchanger, air scavenger, pumps, oil reclaimer, Maxim silencer and inter-connecting piping and fittings as in operation.

STEAM TURBINE GENERATOR UNITS

3 Phase 60 Cycle

5,000 KVA Westinghouse condensing double extraction, 400 lbs. steam pressure, 600° FTT, 125 lb. and 20 lb. extraction, 480 volts, with surface condenser.

2,500 KVA New General Electric condensing extraction, 400/600 lb. steam pressure, 750° FTT, 100-150 lb. extraction, 480/2400/4160 volts, with or without new surface condenser.

1,250 KVA Westinghouse condensing extraction, 150-250 lb. steam pressure, 600° FTT, 10 lb. extraction, 480 volts, with surface condenser.

625 KVA Westinghouse non-condensing, 150-200 lb. steam pressure, 600° FTT, 25 lb. exhaust, 480 volts.

SPECIAL
NEW 2500 KVA TURBINE GENERATOR UNITS
3 Phase 120/180/240 Cycle

3—2500 KVA General Electric Generators, 3 phase, 120/180/240 cycle, 480/2300/4150 volts, direct connected to General Electric Automatic Extraction Condensing Turbines, 400/600 lb. steam pressure, 100/150 lb. extraction pressure.

UNIFLOW ENGINE GENERATOR UNITS

3 Phase 60 Cycle

750 KVA Allis Chalmers-Ames vertical, 150 lb. steam pressure, 5 lb. exhaust, 2400/4160 volts.

625 KVA General Electric-Skinner horizontal, 150 lb. steam pressure, 5 lb. exhaust, 240 volts.

500 KVA Allis Chalmers-Skinner horizontal, 150 lb. steam pressure, 5 lb. exhaust, 240/480/600 volts.

250 KVA General Electric-Ames vertical, 150 lb. steam pressure, 5 lb. exhaust, 480 volts.

UNIFLOW ENGINE GENERATOR UNIT

125 Volts Direct Current

500 KW Crocker Wheeler-Skinner horizontal, 100-125 lb. steam pressure, 5 lb. exhaust, 125 volts direct current.

DIESEL ENGINE GENERATOR UNITS

3 Phase 60 Cycle

1,675 KVA Fairbanks-Morse, 2400/600/480 volts, 300 RPM.
900 KVA Fairbanks-Morse, 2400 volts, 257 RPM.
625 KVA Busch Sulzer, 2400/600/480 volts, 180 RPM.
375 KVA Fairbanks-Morse, 2300 volts, 300 RPM.

Write, Wire or Phone for Further Details and Prices

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. **Telephone: MAin 1-9514** **CLEVELAND 14, OHIO**

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MOTORS—GENERATORS—MG SETS—TRANSFORMERS—CONTROLS

WRITE FOR STOCK LIST No. 1622

VARIABLE VOLTAGE DRIVES

40 HP Reliance Variable Voltage Drives, each Consisting of:
1—40 KW 250 Volt Induction M-G Set, with two auxiliary 5 KW generators and exciter.
1—40 HP 400/1500 RPM, Frame 365T, 230 Volt, DC Motor.
With full magnetic control providing log forward, log reverse, run, fast, slow, and step, and motor operated field rheostat.

SLIP RING MOTORS—3 Ph., 60 Cy.

Qn.	HP	Speed	Volts	Make	Type
6	½ 7½	810	550	G.E.	MTC-5201
2	10	1140	410	West.	HT-7A
2	10	570	220	G.E.	HI-11
2	11½	820*	550	G.E.	ITC-5008
2	15	1160	440	West.	CW-464C
2	15	570	220	West.	CW-646
1	18	680	440	West.	MW-316
1	20	860	440	West.	CW-638
1	25	1130	550	G.E.	MT-323
2	25	350	220	Wagner	BR
2	25	720	440	Wagner	22VBR
1	30	865	440	West.	CW-646
1	30	350	440	G.E.	MTC-332
1	30	675	440	G.E.	MT-336
2	35	600	400	F-M	HV-H16A
2	½ 40	865	2200	Al.Ch.	ARY-223C
1	½ 40	560	440	G.E.	MT-346
2	50	1150	440	G.E.	M-536
1	50	880	440	West.	HF-12A
1	50	570	440	G.E.	MTC-5524
3	532	550	220	G.E.	IQC-5013***
1	60	685	440	West.	CW-758
1	½ 60	570	550	G.E.	MTC-5546
1	½ 60	645	550	West.	CW-638
1	½ 80‡	575	440	G.E.	MTC-5352
2	125	430	440	G.E.	IL-16
2	150	1750	440	G.E.	MTP-549
1	175	565	550	West.	CW-1002
1	200	495	2200	G.E.	IM-17A
1	250	600	2300†	G.E.	IM-17
2	300	900	140	G.E.	IM-17
1	300	880	2200	G.E.	IM-17A
4	350	1775	2300	G.E.	IM-F15A
2	350	880	2200	G.E.	IM-17A
1	400	505	550	West.	CW
1	600	1770	440	G.E.	IM-E15C
1	650**	360	440	G.E.	MT-442Y
1	700	735	4600‡‡	West.	CW

220 volt motors can be reconnected for 440 volts.
‡Intermittent rating. ***2 phase.
**New. ‡‡25 cycle.
†Also 440 or 550 volts. ‡Also 440 or 2300 volts

A.C. GENERATORS — NEW

3 Phase, 60 Cycle, 0.8 P.F., Two Bearing, with Damper Windings, Direct Connected Exciter

Qn.	KVA	RPM	Make	Volts
4	18.7	1800	Columbia	240/120
5	18.7	1800	Columbia	208/120

230 VOLT CONST. SPEED D.C. MOTORS

Qn.	HP	Speed	Make	Type
10	3	850	Reliance	Y-225T
25	3½	850	West.	SK-30
1	7½	1150	G.E.	CDM-65
1	7½	850	G.E.	CD-75
10	10**	1750	Kimble	BA-324
5	10**	1150	Al.Ch.	EB-80
2	10	850	West.	SK-83
10	15½**	600	West.	SK-93
3	15	1750	G.E.	CD-75
5	15	825	West.	SK-90
1	20	1750	L.A.	ON-A-L851
1	20**	1450	G.E.	CDM-83
1	20	1750/1310	West.	SK-83
2	30	1150	G.E.	RC-30
1	30**	1450	G.E.	CDM-38
11	30	750	West.	SK-110L
17	35	825	West.	SK-120
1	30	1100	G.E.	RC-12
1	40	1700	West.	SK-103
1	40	750	G.E.	RC-34
1	50	750	West.	SK-150
1	60	850	G.E.	RC-16
1	60	1750/1310	West.	SK-143
1	150	700	Al.Ch.	
2	200	1150	G.E.	RC-38
1	250	1150	C.W.	CMC-101A

230 VOLT ADJ. SPEED D. C. MOTORS

Qn.	HP	Speed	Make	Type
6	5/7½	600/1800	G.E.	BA-30
1	10	600/1800	Reliance	T-92T
1	12½	230/340	West.	SK-130
10	12½**	600	West.	SK-93
1	15	600/1200	West.	SK-130L
1	30	500/1500	G.E.	RF-11
1	20/25	100/1200	West.	SK-153
1	25	400/1600	G.E.	RF-13
1	25	400/1500	G.E.	RF-12
1	33/29	300/1200	G.E.	RF-13
1	30	400/1200	West.	SK-163
1	30/40**	400/1600	G.E.	CD-1236
1	35	500/1500	West.	SK-143
1	40/50	400/1200	Reliance	T-4611
1	75	500/1500	Cr.Wh.	CCM
1	75	375/750	Cr.Wh.	CMC-125M
3	100	225/900	G.E.	MPC-A
5	100	400/1200	Al.Ch.	
1	100	320/960	West.	SK-200
1	125	450/1000	West.	SK-190
1	175	230/500	West.	SK-220
2	375	350/500	G.E.	MPC

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.

Totally Enclosed Fan Cooled, Ball Bearing

Qn.	HP	RPM	Volts	Make	Type
1	5	3480	220	G.E.	K-225
2	5	1750	440	L.A.	JA-254
10	5	1730	440	G.E.	K-254
5	7.5	1740	440	G.E.	K-284
1	10	3480	440	West.	CS-324
1	10	1140	440	Wagner	CP2-326
1	10**	880	220	West.	CS-365-EXP
1	15	1745	440	West.	CS-326
1	15	1175	440	L.A.	JA-365
1	20	1760	220	G.E.	K-364
1	25	1760	220	G.E.	K-365
1	25	1200	550	G.E.	K-405
1	25	1170	220	L.A.	JX-405
1	25	705	440	West.	CS-W504
1	40	3585	440	G.E.	KF-4038

SPLASHPROOF, BALL BEARING

Qn.	HP	RPM	Volts	Make	Type
24	5	1750	440	L.A.	F8-254
1	5	1735	220	G.E.	K-254
1	5	1160	440	L.A.	FX-284
1	10	3480	440	G.E.	K-284
1	15	1175	440	L.A.	JA-365
4	15	1150	440	L.A.	FX-365
2	40	1175	220	G.E.	K-445
2	50	1760	440	L.A.	FX-445A
5	50	1160	220	G.E.	K-504
1	150	1775	440	L.A.	FX-1168
3	150	880	440	L.A.	FX-1368
1	150	700	440	G.E.	KF-6335

OPEN TYPE MOTORS

Qn.	HP	Speed	Volts	Make	Type
1	15	3485	220	Reliance	AA-B3247
5	15**	1735	440	Century	SC326
1	15	1200	220	G.E.	KT-502
1	15	900	220	G.E.	FTR-512
1	20**	3475	220	West.	CS-326
5	20**	1750	440	Wagner	RPI-364
1	20	1750	220	West.	CS-W364
1	20	1200	220	G.E.	KF-512
2	20	1160	440	West.	CS-464C
2	20	900	220	G.E.	FTR-522
1	25	1800	220	G.E.	KT-512
5	25**	1740	440	Century	SC-364
1	25	1160	440	West.	CS-667C
1	25	900	220	Howell	SCRB-356***
2	25**	875	440	Master	PB-405
2	25	575	440	G.E.	KT-542
3	30	3550	550	G.E.	K-3648
1	30	1160	440	West.	CS-644
1	30	870	220	West.	CS-646
1	40**	3545	220	G.E.	KF-4048
2	40	1750	440	West.	CS-583C
2	40	900	2300	G.E.	FTR-536
4	50**	1750	440	Wagner	RP5-405
1	50	850	220	West.	CCL
2	60**	1750	440	Ideal	AH-444
2	60	900	440	G.E.	KT-346
1	75	1160	440	West.	CS-662C
4	75	870	220	West.	CS-766A
2	75	865	2300	G.E.	KT-332
1	100	690	220	West.	C
1	100	580	2200	G.E.	IK-15A
2	100	580	2200	West.	CS-930
1	100	495	2200	Al.Ch.	AN
2	125	435	440	Al.Ch.	AR
2	125	400	2300	G.E.	I-17-FR
1	200	580	550‡‡	G.E.	KT-5668
2	300	587	2200	West.	CS-39A
1	400	1165	2200	G.E.	IK-E15B
1	500	1200	140	G.E.	KTP-567
1	700	1800	2300/ 4000	West.	CS-4-39D-12

220 volt motors can be reconnected for 440 volts.
**New. ***2 Phase. ‡‡Reconnectable for 440 volts.

G. E. DYNAMOMETER

Cradle Type, with control and Dial Scale.
(Write for Complete Specifications.)

Qn.	HP	DC Volts	RPM	Type
1	200	250	1200	C

MOTOR GENERATOR SETS

125 and 250 Volts D. C.

(Write for complete Specifications)

KW	Make	RPM	DC Volts	AC Volts
2	Cont.	1750	125	220/440
7.5	West.	1485	125	580/230§
10	West.	1750	125	220/440
10	West.	1450	125	*220/440†
10	West.	1150	250	220/440
15**	G.E.	1800	125	220/440
15	G.E.	1755	250	220/440
15	West.	1450	125	220/440§
18	West.	1750	125	2200/440
25	G.E.	1200	125	220/440
30	G.E.	1800	250	220/440
30	Al.Ch.	1750	125	220/440
50	West.	1750	250	220/440
50	G.E.	1730	125	220/240†
75	G.E.*	1200	125	220/240

Note: 3KW, 5KW & 7.5KW, 250V Sets Available.
**New. *Synca. Motor Driven. §50 Cy. †25 Cy.

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ELECTRIC GENERATOR & MOTOR CO.

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CIRCUIT BREAKER

1—2000 AMP., WEST. DA-75, 220/3/60
NEW 1943—USED 3 YEARS.

ADJUSTABLE SPEED MOTOR

1—30 HP, GE TYPE CD 1337, 230 V, DC, 300/1800 RPM. NEW.

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All ASME Code—Inspection Guaranteed

- 2 ea. 3684 HS HWW Cross Drum, Steel Sectional Heater WT: 350# WP; Steel Encased. Integral furnaces. Perfect. 1934
- 2—100 HP Fitzgibbons 893HS Built 1942. Perf. Condition. Location: Illinois.
- 1 #590 Kewanee, 125#, 2501 HS, 1941
- 2 #587 Kewanee, 125#, 1429 HS, gas, 1943
- 1 Titusville Scotch Marine 15#, Wet Back, No. 80H-242, 1941.
- Late 10-15-20 HP Vt. Tub. Boilers. Inquire.

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Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

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CONSULT US FOR

Diesel Gasoline and Steam Generators, Electrical and Industrial Equipment

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1050 HP SLIP RING MOTOR

G.E. MT8 3/25/2300 375 RPM, PED. BEAR. #3884907 with AUTOMATIC Control Panels. Six Point.

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TURBINE FOR SALE

300 K. W. Gen. Elec. Curtis Steam Turbine type ATB 8 P.F. 3 phase, 60 cycle, 480 volts 3600 R.P.M. Serial #4218901—4 Stage 150# steam pressure. 1st Stage Bleeder at 10 lbs. steam. Alternating current, condenser type. No. 28040 Synchroscope and voltmeters, complete with Worthington condenser. Condition—very good.

Victoria Paper Mills Company, Fulton, New York

FOR SALE

Complete D.C.

Steam Generating Equipment

Including two 400 HP Nordberg uniflow engines driving two 250 KW Crocker-Wheeler generators; two 1500 HP Nordberg uniflow engines driving two 750 KW Crocker-Wheeler generators; two Crocker-Wheeler electric balancer sets; and misc. equipment. Located midwest and all in first-class operating condition.

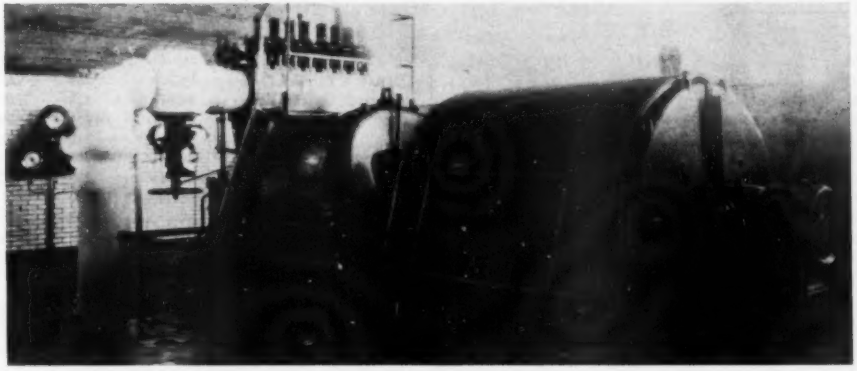
FS-8689, POWER
330 W. 42nd St., New York 18, N. Y.

6250 G. E. TURBINE-GENERATOR

K V A **A VERY HIGH GRADE MACHINE**

FOR SALE—BARGAIN!

6250-KVA., G.E., TURBINE-GENERATOR
250#G.psi., 3600-RPM., 3/60/2300-4160-V



The Above 6250-KVA., General Electric Turbo-Generator, 3600 RPM, is in No. 1 Condition and Good for 15 Yrs. Continuous Service. Is Complete with 7000-sq. ft., 2-pass Surface Condenser and Condenser Auxiliaries. Will Deliver any Point in Canada, DUTY FREE.

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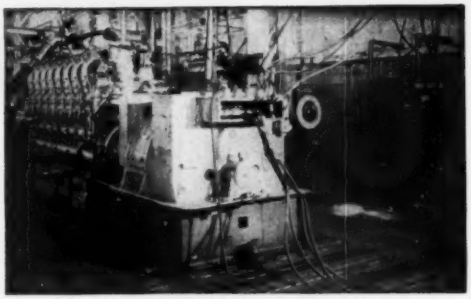
DIESEL POWER

AT 40% TO 60% SAVINGS

EACH ENGINE "REMANUFACTURED"
AND "FULL-LOAD TESTED"
PRIOR TO SHIPMENT

INSPECTION INVITED

ALL EQUIPMENT OFFERED WITH ONE YEAR GUARANTEE



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A PARTIAL LIST OF OUR INVENTORY

KVA	MAKE	MODEL	HP	RPM	KVA	MAKE	MODEL	HP	RPM
1875	Fairbanks Morse	33E16	2000	300	312.5	Clark	MD-4	375	327
1420	Fairbanks Morse	38D	1600	720	300	Fairbanks Morse	YVA	360	257
1250	General Motors	16-278A	1600	720	250	General Motors	8-268A	350	1200
1000	General Motors	12-278A	1200	720	237	Ingersoll-Rand	S	255	600
937.5	General Motors	12-567	1080	720	200	Buckeye	80	240	600
625	Alco	6-12½x13T	750	600	156	Buckeye	E	190	400
425	Baldwin	VO	510	450	125	General Motors	3-268A	150	1200
400	Buckeye	80	480	600	121	Fairbanks Morse	32E14	140	300
375	Enterprise	DSG-6	450	450	75	General Motors	6-71	90	1200
330	Superior	KNA	396	514	62.5	Int'l Harvester	UD-18	76	1200
312.5	General Motors	8-268A	450	1200	50	General Motors	4-71	60	1200

A. G. SCHOONMAKER COMPANY, INC.

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J. E. BERGER CORP. OFFERS LARGE MOTORS

SQUIRREL CAGE BARGAINS

10—250 HP Westighouse—Type CS—S. S. Bearing—Frame 875-S —1800 RPM—3—60—2300 Volts.

10—200 HP Wagner—Type RP—S. Bearing—Frame 26V—1800 RPM—3—60—440 Volts.

4—150 HP General Electric—Type K—TEFCBB—Frame 6335—720 RPM—3—60—550 Volts.

2—100 HP Allis-Chalmers—Type ARW—Skirted Frame—S. Bearing—1800 RPM—3—60—2300/4150 Volts.

10—75 HP Wagner—Type CPI—TEFCBB—Frame 504—1800 RPM —3—60—220/440 Volts.

10—60 HP Wagner—Type CPI—TEFCBB—Frame 445—1800 RPM —3—60—220/440 Volts.

These Motors are modern and have had very little use.

All our motors are offered completely Guaranteed and almost like new.

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CENTRIFUGAL PUMPS

4—Allis Chalmers Electrifugal, Size 6" x 5" SSL 20 H.P., 220 or 440 volt, 3/60—1800 RPM, Splash proof. Cap. 1000 GPM, 68' head.

2—Fairbanks-Morse, Size 3"—5532 with 15 H.P. 220/440/3/60—1800 RPM, Splash proof motors. Cap. 300 GPM, 100' head.

2—Vacuum, Size O Nash Hytor, 50 CFM, 15" hg.

2—Beach-Russ, Size 5, Vacuum, 60 CFM, 26" hg.

MOTORS

1—50 H.P. G.E. Slip Ring 220/3/60—900 RPM with drum and grids.

Large stock of pumps, motors and air compressors at all times. Let us have your inquiries.

C-B EQUIPMENT AND PUMP CO.

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ELECTRICAL CABLE

- for every industrial and power application
- Special constructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular suppliers.
- Cut to length. Reasonably priced.

UNIVERSAL WIRE AND CABLE CO.
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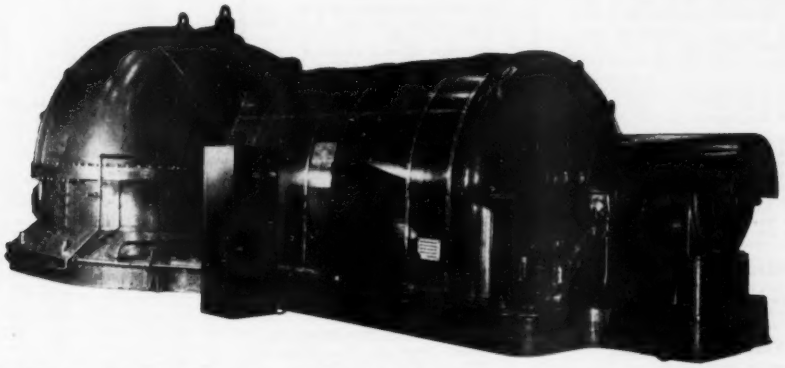
GENERATE YOUR OWN POWER
with "UTILITIES APPROVED" EQUIPMENT



25,000 KVA M—20,000 KW, 80% P.F., 3 phase 60 cycle, 13,200 volts, 1800 RPM General Electric Company condensing turbine generator unit 200-215 P.S.I.G., 540° total temperature complete with direct connected shaft exciter, switchboard and instruments, a 30,000 sq. ft. 2-pass Westinghouse surface condenser, motor driven and turbine driven pumps and condensing accessories.

EXCELLENT CONDITION — COMPLETE INSTALLATION — PROMPT DELIVERY

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

6250 KVA G.E. condens., 3-stage, 2300/4000 volts, 200# P.S.I., 600°TT.

3125 KVA G.E. condens., 150#, 550 volts.

2500 KVA G.E. Type ATB, Form HT, 2300/480 volts, 3600 RPM, two bearing alternating current generator LESS TURBINE.

2500 KVA G.E. condensing 200 P.S.I. 2400/600/480 volts.

937½ KVA Allis condensing 250 P.S.I., 700° total temperature, 480/600/2400 volts.

937 KVA G.E. bleeder condensing 215 P.S.I.G., 15# extraction, 2300 volts.

625 KVA G.E. non-condensing 150 P.S.I., 20# back, 480 volt.

625 KVA G.E.—Murray condensing 250 P.S.I., 2300 volts.

375 KVA (4) G.E. condensing 400# pressure, 480/600/2300/4150 volts.

125 KVA G.E. non-condensing, 150-200 P.S.I., 2300 volts.

125 KVA Westghse. non-condensing 150/250 P.S.I. 2400 volts NEW

Direct Current

300 KW Westghse. 3-wire, 250 volt 150/250# P.S.I. non-condensing

150 KW (2) Westinghouse-Worthington, 250 volts, 3-wire, 225-250 P.S.I. condensing.

100 KW (2) G.E. 125 volt, 200/275 P.S.I. non-condensing

75 KW (2) Westinghouse-Moore, 120 volt, 200# P.S.I. condensing.

60 KW (3) new Westinghouse, 120 volt, 200# P.S.I. condensing.

MOTOR GENERATOR SETS

150 KW G.E., 125 volt direct current generator connected 225 HP, 3 phase, 60 cycle, 220 volt, synch. motor.

100 KVA Westghse. 60 cycle, 2400 volts, 900 RPM alternator direct connected 135 HP, 220 volt direct current motor.

62½ KVA G.E., 60 cycle, 2300 volt alternator to 75 HP, 125 volt DC motor.

FEBRUARY BARGAINS
SPECIALLY PRICED

22,500 sq. ft. Alberger — 21,000 sq. ft. Wheeler
4,400 sq. ft. Worthington SURFACE CONDENSERS

3—10,000 GPM 24" suction 20" dis. Cent. pumps each direct connected motor.

1—10,000 GPM 24" suction cent. pump direct connected motor.

1—10,000 GPM 24" suction cent. pump direct connected G.E. non-condens. turbine.

1—5425 GPM, 70 foot head Centrifugal pump connected 125 HP 60 cycle, 2200 volt, 1750 RPM G.E. motor.

2—1000 GPM, 1270 foot head, 4-stage Morris pumps each connected 417 HP, 3300# P.S.I. non-cond. G.E. turbine.

1—G.E. Bank of Scott connected 2 to 3 phase, 60 cycle transformers, 2500 KVA capacity.

1—20 KW 125 volt direct current generator connected Hill Diesel engine.

9—250 KVA single phase, 60 cycle Westinghouse transformers 11,000/444 volts.

UNAFLOW GENERATOR UNITS

Alternating Current—3 phase, 60 cycle

625 KVA 40°C Rise, General Electric, 240 volts generator connected Skinner non-condensing engine, 150 P.S.I.

500 KVA G.E., 2400/480/240 volts generator connected Ames Vertical Engine, 150#.

375 KVA G.E., 2300/440 volts generator connected 23"x24" Skinner Horizontal Engine.

175 KVA Westghse., 240 volt generator connected Skinner Horizontal Engine, 125-150# P.S.I., 5# gauge back.

Direct Current

400 KW G.E. 250 volts, 360 RPM generator connected Skinner vertical engine 150#.

275 KW Westinghouse, 250 volt generator connected Ames vertical engines, 150#.

250 KW (2) G.E., 3-wire, 250 volts generators connected Skinner engines, 150#.

SYNCHRONOUS MOTORS

5000 KVA Westinghouse, 4000 volt, 720 RPM Electrical Synchronous (condenser).

900 HP Allis, 2200 volts, 150 RPM.

300 HP G.E., 80% P.F., 2300 volts, 720 RPM.

INSTALLATION CONSISTING OF:

3—187 KVA, 3 phase 60 cycle 240 volt generators direct connected Buckeye Diesel engines. Complete.

UMC UTILITIES MACHINERY CORP.
1965 EAST 6th STREET • CLEVELAND 14, OHIO • Long Distance 422

BREW-WOLTMAN OFFERS

TURBINE UNITS

1—12500 KVA Allis Cond. 60 cy. 13800 V. 300-lb.
1—10000 KVA G.E. Cond. 25 cy. 6000 V. 200-lb.
1— 5000 KVA West. Extr. Cond. 60 cy. 480 V. 385-lb.

1— 2500 KVA Worthington Non-C. 60 cy. 2300 V. 150-200-lb. 40-lb. BP
1— 2500 KVA G. E. Extr. Cond. 60 cy. 480 V. 185-200-lb. steel valve chest.
1— 2500 KVA G. E. Cond. 60 cy. 2300 V. 150-lb.
2— 2250 KVA G. E. Cond. 60 cy. 240-400 lb.
1— 1875 KVA Moore Cond. 50 cy. 2300 V. 225-lb.
1— 1250 KVA Allis Cond. 60 cy. 2300 V. 150-200 lb.
1— 1250 KVA Allis Cond. 60 cy. 2300 V. 150-200-lb.
2— 1250 KVA Elliott Cond. 60 cy. 480 V. 150-200-lb. 600" Surface Condenser
1— 938 KVA G.E. Extr. Cond. 60 cy 240 V. 200-lb.
1— 625 KVA G. E. Cond. 60 cy. 240 V. 200-lb.
2— 250 KVA Elliott Non-C. 60 cy. 208 V. 200-lb. 5-lb. BP
1— 75 KW West. Cond. 125/250 V. DC 400-lb.
1— 25 KW Allis Non-C. DC 125 V. Exciter Dual drive turbine & motor.

DIESEL ENGINE UNITS

2—1400 HP Fair. Morse 2400 V. 60 cy.
3— 700 HP Gen. Motors 2300 V. 60 cy.
3— 650 HP Amer. Loco. 440 V. 60 cy.
1— 600 HP Fair. Morse 2400 V. 60 cy.

STEAM ENGINE UNITS

1—500 KVA Skinner Uniflow 440 V.
1—250 KVA Ames Vertical Uniflow 480 V.
1—250 KVA Ames Uniflow 480 V.
2—187 KVA Ames Vertical Uniflow 240/480 V.
1—156 KVA Ames Vertical Uniflow 240 V.

ROTARIES—60 CY.

QU.	KW.	MFR.	VOLTS-DC	TRANS.	RPM
1	3330	G.E.	325/285	13800	300
1	2000	A.C.	600	4150	514
2	1000	West.	600	4150	720
1	1000	G.E.	600	13200	900 Auto.
2	500	West.	250	13200	1200

SPECIALS

3—700 HP General Motors Diesel 8 cyl. 4 cy. 360 RPM dir. con. to 485 KW .8 PF 3/60/2300 V. generators.

2—1250 KVA Elliott 3/60/480 V. 3600 RPM generators dir. con. to 150-200 lb. IP 600° TT turbines with dir. con. exciters surface condensers and pumps.

MERCURY ARC RECTIFIERS

QU.	KW.	KIND	DC VOLTS	TRANS.
3	4500	Multi Anode	600	13800
1	3250	Ignitron	650	33000
2	1850	Ignitron	300	33000
1	1000	Ignitron	600	13800

MOTOR GENERATOR SETS—60 CY.

QU.	KW.	MFR.	VOLTS-D.C.	A.C.	RPM
1	1500	West.	250	4600	514
1	1000	G. E.	600	13200	514
1	500	West.	125	2300	720
1	400	G. E.	250	6600	720
1	200	G. E. 3 Wire	250	2300	1200
1	75	Star	240	440	1200
1	75	West.	125	440	1200

SYNCHRONOUS CONDENSERS

QU.	KVA	MFR.	VOLTAGE	RPM
1	2500	G.E.	2400/4160	720
1	2000	West.	2300	720
1	1500	G.E.	4600	900
1	1500	West.	2300	900
1	1000	West.	2300	900

SYNCHRONOUS MOTORS—60 CY.

QU.	HP	MFR.	VOLTAGE	RPM
1	4330	Cr. Wh.	13800	514
1	1000	E. M.	2400	600
2	700	West.	2300	200
1	600	G.E.	440	300
2	350	G.E.	2300	257
1	300	G.E.	2300	600
1	300	West.	2300	900

FREQUENCY CHANGERS

QU.	KVA	MFR.	CYCLES	RPM
1	3125	G. E.	25/60	300
1	3000	G. E.	60/25	300
2	2500	G.E.	25/62½	750
1	2450	G. E.	62½/25	750
1	1250	G. E.	25/60	300
1	1230	West.	25/60	300
2	1000	G. E.	25/60	300
1	300	Al. Ch.	25/60	300

TRANSFORMERS—60 CY.

1— 7500 KVA G.E. 138000—41000, 3 ph.
3— 3333 KVA West. 132000—7620/13200 Y
1— 2000 KVA G.E. 66000—13800/23900 3 ph.
3 —1000 KVA West. 66000—2400, 3 ph.
1— 2500 KVA G.E. 59/73 KV, 5 taps, 3 ph.
3— 100 KVA West. 44000—2200/12470 Y
3— 75 KVA G.E. 44000—2300/4600
3— 8333 KVA West. 43800—13900
4— 6667 KVA G.E. 38100/66000Y—12700/22000 Y/13200
1—18750 KVA A.B.B. 34840—11000, 3 ph.
6— 167 KVA G.E. 34500—2300/4000 Y
2— 7500 KVA Al. Ch. 33000—13800, 3 ph.
1— 3000 KVA G.E. 33000—2300/4600, 3 ph.
6— 200 KVA G.E. 33000—2300/6900
6— 75 KVA Mol. 33000/16500—2300/6900
3— 75 KVA Wag. 33000—2200/12470 Y
6— 50 KVA G.E. 33000—2300
2— 4500 KVA G.E. 27000—2300, 3 ph.
3— 3750 KVA West. 26400/13200—2400
1— 450 KVA Al. Ch. 25410/44000—13200/23000
2— 1000 KVA G.E. 22000/11000—2300, 3 ph.
3— 750 KVA West. 13200—440
3— 333 KVA West. 13200—440
1— 200 KVA G.E. 11500—220/110
1— 200 KVA Mol. 11000—2300
4— 167 KVA G.E. 7200/12400—240/480
1— 1500 KVA West. 4000—2300, 3 ph. Auto
3— 250 KVA Al. Ch. 2300—460
6— 75 KVA G. E. 480—120/240

OIL CIRCUIT BREAKERS

1— 600 A. 73 KV G.E. FHKO-139 Outdoor
1— 600 A. 73 KV G.E. FHKO-139-1000 Outdoor
1— 400 A. 73 KV G.E. FHKO-236-500 Outdoor
1— 400 A. 37 KV G.E. FHKO-236-500 Outdoor
4— 600 A. 15 KV G.E. FHKO-139-750 Outdoor
2— 600 A. 15 KV West. B-28-B-500 Indoor

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW. WOLTMAN & CO., INC.

50 Church Street — New York City 7, — WOrth 4-1470

NORTHERN METAL CO. — MACHINERY at REDUCED PRICES

DIESEL GENERATORS

100 K.W. Allis Chalmers. 1944. 3/60/120/450.
Exciter: 3 K.W. 120 V. D.C.
Diesel Engine. Lorimer. Model FSSS. 150 H.P. 7½"x9½".
5 cylinder, with electric starting motor.

MOTORS

Westinghouse. 1944. Synchronous—Induction.
60 Pole. 3300 S.H.P. 3 Phase. 82.5 Cycles: 2200 Volts.
165 R.P.M. Power Factor 100%.
Exciter: 125 Volts D.C. Load Factor 100%. 1944.

BOILERS

WATER TUBE. Babcock & Wilcox. 1945. 2 Drum. Bent Tube. Economisers. Internal Desuperheater. Superheaters: W.P. 400 P.S.I. Hydrostatic Press. 718 P.S.I. Heating Surfaces: 2441 sq. ft. Superheater 350 sq. ft. Economiser 1620 sq. ft. 3 Todd "Hex Press" Fuel Oil Burners. Diamond Soot Blowers. Auxiliaries available.

NUMEROUS OTHER ITEMS ARE AVAILABLE

MILNOR & BLEIGH STS. • PHILA. 35, PA.
Phone MAyfair 4-1400

COMPRESSORS
VACUUM PUMPS

EVERYWHERE — ANYTIME
IT'S AMERICAN REBUILT
Since 1902
ALL MAKES — ONE QUALITY
— SALE OR RENT —
STATIONARY — PORTABLE

SPECIAL
868 CFM—125 LBS.
17/10x12 CHICAGO PNEUMATIC
O-CB
Inspect Our Plant

American Air Compressor Corp.
Dell Ave. & 47 St., North Bergen, N. J.

asme — BOILERS — Nat'l B'd.

2—404 H.P. Springfield sectional header
1—250 H.P. Stirling, Class-H. Coxe Stoker
2—400 H.P. built in 1942 (used 3 years) COMPLETE PLANT, forced & induced draft fans, stacks, Spreader stokers & oil burners.

H. P. BREARLEY
34-23 81st STREET JACKSON HEIGHTS, N. Y.

LIQUIDATION SALE — Modern Equipment

DIESEL ENGINES

HP	MAKE	MODEL	RPM	CYCLE
1800	General Motors	16-258S	900	4
1600	General Motors	16-278A	720	2
1600	Fairbanks Morse	38D O/P	720	2
1600	Hamilton	RB99-D.A.	700	2
900	General Motors	12-567 ATL	750	2
900	General Motors	6051 (quads)	650	2
500	Superior	6-cyl.	514	4
215	Superior	VDM B	600	4

DIESEL GENERATOR SETS

DC	1200 KW	525V	750 RPM	General Motors	16-278A	
	650 KW	240V	750 RPM	General Motors	12-567	
	125 KW	120/240	600 RPM	Superior	VDMB	
	100 KW	120/240	1200 RPM	General Motors	3-268A	
	60 KW	120V	1200 RPM	Buda	909	
AC	200 KW	3/60/450	1200 RPM	General Motors	3-268A	rebuilt
	100 KW	3/60/450	1200 RPM	General Motors	3-268A	rebuilt

3—150 KW 3/60480 600 RPM Buckeye model 80 diesel
6—100 KW 3/60/460 600 RPM Worthington BB5 diesel
With Westinghouse generators, exciters, cooling systems, starting equipment, switchboard, silencers, etc. Units practically new.

TURBO-GENERATORS—D.C.

1—375 KW 180/240 V GE Shunt. 1200 non-cond.
5—300 KW 120 V Whse. Compd. 1200 cond.
1—300 KW 240 V GE Compd. 1200 cond.
12—150 KW 120 V Whse. Shunt. 1200 cond.
12— 60 KW 120 V Whse. Stab. Sh. 1800 cond.
1— 25 KW 125 V 3600

MOTORS—DC

1500 HP 525 V DC 600 RPM W'hse.
1362 HP 415 V DC 1200 RPM Elliott
667 HP 375 V DC 1300 RPM Elliott
444 HP 250 V DC 900 RPM Elliott
222 HP 230 V DC 3050 HP W'hse
50 HP 230 V DC 525/1800 W'hse.
15 HP 120 V DC 500 RPM Diehl

GENERATORS—DC

1200 KW 525 V 750 RPM All. Chalm.
1075 KW 375 V 750 RPM Elliott
700 KW 240 V 500/720 Elliott
375 KW 240 V 1200 W'hse.

AIR COMPRESSOR

2000 CFM at 90 psi, 3 stages, driven by 450 HP diesel mfr. Clark Bros.

NEW PUSHBUTTON STARTERS

2000—Line Starters, magnetic, for AC motors, rated 7½ HP at 440V, 5 HP at 230V, 3 HP at 110V, mfd. by Ward Leonard and Westinghouse.
80—Line Starters, 115V DC, 9.5 amps, G.E. (NEW).

HIGH PRESSURE AIR COMPRESSORS
CENTRIFUGES
EVAPORATORS
TRANSFORMERS
SOOT BLOWERS
WINCH TYPE MOTORS

MODERN TURBO GENERATORS AC

1—2000 KW 3 phase 60 cycle 3600 RPM 480/600/2400/4160V type ATB-2 Form HL driven by steam turbine, 410# steam pressure, exhaust 2½" Hg abs., 275 deg. F superheat. General Electric Company. (also 2900 at 1700 V)
3—250 KW G.E. type ATI 3/60/450 1200 RPM condensing.
2—200 KW Westinghse. 3/60/450 1200 RPM condensing (unused).
6—200 KW G.E. type ATB 3/60/450 1200 RPM cond. and non-cond.

GENERATORS—AC

3—2000 KW 3/60/480/600/2400/4160 3600 RPM type ATB-2 Form HL. Mfd. by G.E.

MOTORS—AC

4—6000 HP at 93-1/3 cycle 400 RPM or 3800 HP at 60 cycle 257 RPM—G.E.

ICE PLANTS (New)

3—22 ton capacity, Freon 12, mfd. by Frick.

BOILERS

10—Cleaver-Brooks, 2000# steam pr. hr 35# press.
2—Cyclotherm 3000 pounds steam per hour, 125# press.
1—Express Boilers, modified D type, Foster Wheeler 30,000# steam/hr., 435#.
2—Type "D", water tube, Foster Wheeler, 15000# steam/hr., 275# press.

STEAM TURBINES

All New

1—110 HP 250# steam, 10# each. 1200 RPM Sturtevant
10—56.5 HP, 300-475# steam, 10-15# each. 1225-1600 RPM, Sturtevant

CONDENSERS

(Most are new)

No.	Sq. Ft.	Make	Passes	Tubes	
2	8000	C.H.Wheeler	2	Brass	⅝"
4	3300	Str. Wells	2	Alu-Brass	¾"
4	1050	Conseco	2	Cu Ni	⅝"
30	400	All. Chalm.	2	Brass	⅝"
4	300	Wheeler	2	Cu Ni	⅝"
8	155	Conseco	2	Brass	¾"

AIR EJECTORS

1—Foster Wheeler for 3800 sq. ft. cond.
5—Westinghouse type C-42, for 9300 sq. ft. condenser.
2—Ingersoll Rand 275# press., for 8250 sq. ft. condenser.
2—C. H. Wheeler, type 4H240, for 8000 sq. ft. condenser.

HYDRAULIC PUMPS

Vertical quintuplex pumps, 450 GPM, 1750 psi, 128 RPM, mfr. Aldrich, with 700 HP 3/60/2300 motors.

AXIAL FLOW FANS

16,000 CFM 3" S.P. 3/60/440 Buffalo
12,000 CFM 3" S.P. 3/60/440 Clarage
35,000 CFM 1" S.P. 230V DC Wing

BLOWERS — AIR PUMP

5—Blowers, Roots Connersville, size 16x18, serial No. 14862, capacity 5000 CFM against 6 lb. sq. in. ga. pressure or 3450 CFM when creating 20" Hg vacuum.
1—Air Pump, Ingersoll Rand, type FS548, 3500 CFM, discharge press. 24.22 abs., intake press. 20.81 abs., with 125 HP motor 3/60/2300.
1—Air Pump, Ingersoll Rand, type FS548, 6890 CFM, discharge press. 20.86 abs., intake press. 17.10 abs., with 150 HP motor 3/60/2300.
1—Blower, Buffalo, size 60, type R, with 150 HP motor 3/60/2200.

WIRE ROPE SLINGS

Dia. from ⅝" to 3½"
Length from 10 ft. to 150 ft.

HOISTS

15—15,000# pull at 78 FPM, 3360# pull at 348 FPM and 2 auxiliary drums. Driven by Chrysler 28.35 H.P. gasoline engines. (NEW).

HEAT TREATING FURNACES

BOILER FEED PUMPS
FIRE, IRRIGATION AND GENERAL SERVICE PUMPS
OXYGEN PRODUCING PLANTS
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MOTORS - M.G. SETS - CONTROLS

AT REDUCED PRICES!

M-G SETS

1—100 KW Star, 250 Volt D.C., 220/440-3-60 A.C., Ball Bearing.

2—50 KW New Ideal, 250 Volt D.C., 75 HP, 1800 RPM, 440-3-60, 70% Syn. Motor Frame 326.

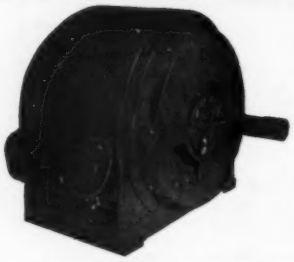
M-G SETS

KW	D.C. Volts	A.C. Volts	Mfg.
400	125/250	2300	Ideal
300	125/250	440/2300	Allis (New)
200	250	2200	Whse.
200	125/250	2200	G.E.
150	250	440	G.E.
125	125/250	2300	G.E.
75	250	440	Allis
60	250	220	G.E.
30	250	440	Ideal
7½VS	250	220/440	Rel (New)

Reconditioned and guaranteed

SYNCHRONOUS

HP	RPM	Volts	Mfg.	Type
900	150	2200	Allis	80%
650	138	2300	Whse.	Engine
500	514	440	E-M	100%
400	900	2300	Whse.	80%
400	720	440	G.E.	80%
350	200	2300	Whse.	100%
300	720	440	Whse.	80%
250	514	2300	A-C	90%
150	900	2300	G.E.	100%
75	900	220	E-M	80%



SLIP RING — R & G.

HP	RPM	Volts	Mfg.
800	514	2300	Whse.
500	1200	220/440	Elliot (New)
500	450	2300	G.E.
450	514	440	Whse.
400	900	2300	G.E. (New)
350	450	2300	Whse.
300	600	440	G.E.
200	1200	440	G.E.
150	1200	2300	G.E.
50	720	220	Whse.

NEW AIR CIRCUIT BREAKERS

10—New 600 amp., ET-20, 3 pole, 3 trip, ITE Air Circuit Breakers, 600 volts.

NEW DIRECT CURRENT

230 Volt Drip proof — ball bearing

Qu.	HP	RPM	Mfg.	Frame
3	3	690/2660	G.E.	284
10	5	850/1700	G.E.	CD-66
5	7½	575/1750	G.E.	CD-77
1	10	575/2300	L.A.	4051
3	10	1750	Rel.	T-34
5	250	1750	A-C	149

Reconditioned and guaranteed

230 VOLTS D.C.

HP	RPM	Mfg.	Brg.
250	400/1200	E-D	Ball.
200	400/1200	Rel	Ball.
150	350/1200	Whse.	Ball.
125/150	250/1000	Rel	Sleeve
100	475/1350	E-D	Ped.
75	500/1500	C-W	Sleeve
*60/75	300/1200	Whse	Sleeve
50	400/1200	G.E.	Sleeve
50	350/1050	Whse.	Ball.
40	400/1600	C-W	Ball.
30	400/1200	Rel (TEFC)	Ball.
30	700/1400	Rel (TEFC)	Ball.
25/30	500/1500	Rel	Ball.
25	690	Rel	Ball.
20	300/1200	Rel	Ball.
15	575/1000	Rel	Ball.
15	700/1350	Rel	Ball.
10	600/1200	Rel (TEFC)	Ball.
10	850	Rel	Ball.
7½	400/1600	Rel	Ball.
7½	600/1800	Rel (TEFC)	Ball.
7½	200/1200	Whse (TEFC)	Ball.
5/7½	400/1600	Whse	Ball.

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WAlbridge 1195

BOSWICK ELECTRIC CO.

P.O. BOX 55 AKRON 9, OHIO

MOTORS - M. G. SETS - COMPRESSORS, ETC.

FAST SHIPMENT

MOTOR GENERATOR SETS

3 ph. 60 cy.

KW	MAKE	RPM	D.C. VOLTS	A.C. VOLTS
500	Cr. Wh.	720	250	2300
300	G.E.	1200	250	4000/2300
300	West.	1200	550	4600/2300
240	G.E.	1200	250	4000/2300
200	G.E.	1200	250	4000/2300
150	West.	1200	125	2300/440
150	Ridg.	900	250	2300
100	G.E.	1200	250	2300/440
100	Ridg.	1200	250	2300/440
75	West.	900	75	440/220
35	G.E.	1800	125	440/220

Also Smaller Units In Stock

ROTARY CONVERTERS

KW	MAKE	RPM	D.C. VOLTS	A.C. VOLTS
300	G.E. HC12	600	250	4000/2300
300	G.E. HCC6	1200	250	4000/2300
150	G.E.	1200	250	4000/2300

Other sizes available

AIR COMPRESSORS

1575 CFM, 100#, PRE2 Ing. Rd. direct conn. to 265 HP, 2300 v. syn. motor.

741 CFM, 100#, OCB, Chg. Pn. belted 150 HP motor.

500 CFM, 100#, Allis Rotary direct connected 100 H.P. B.B. Motors.

A.C. MOTORS—3 Ph. 60 Cy.

HP	MAKE	RPM	TYPE
1500	West.	435	CW—Sl.Rg.
508	G.E.	450	MT412—Sl.Rg.
350	West.	600	CW1106—Sl.Rg.
300	G.E.	450	IM—Sl.Rg.
200	G.E.	1200	MI—Sl.Rg.
160	G.E.	600	IK-16—Sq. Cg.
150	West.	514	CS954—Sq. Cg.
150	G.E.	600	ATI—Syn.
125 (3)	Allis	900	ARY—Sq. Cg.
100 (2)	Allis	720	ARX—Sq. Cg.
100 (5)	West.	1200	CS752C—Sq. Cg.
100 (2)	G.E.	450	IM16—Sl.Rg.
75	West.	900	MS342 Sq. Cg.
75	G.E.	600	ITC5013A
50/12.5	G.E.	900/450	IM 2200 v.
40	G.E.	1200	MT336—Sl.Rg.

Also Smaller Units In Stock

D.C. ADJUSTABLE SPEED MOTORS

250 Volts

HP	MAKE	SPEED	TYPE
375	West.	430/860	Ped.
200	West.	400/800	SK210
150	West.	400/800	SK201
125	West.	450/1000	SK193
60	West.	435/870	SK185
50 (2)	Elec. Dyn.	190/760	

Also Smaller Units In Stock

Send us your inquiries for any POWER EQUIPMENT you may require.

MOORHEAD ELECTRICAL MACHINERY COMPANY

361 Noblestown Road Oakdale, Penna. Pittsburgh District

FOR SALE IMMEDIATELY

750 H.P.—500 K.W. WORTHINGTON DIESEL GENERATOR SET COMPLETE IN ALL DETAILS. Panel Board — starting equipment—Write for complete set pictures, description and price. This is a real buy!

Roger Pierce Equipment Sales Co.
808 Newhouse Bldg. 3-3973
Salt Lake City, Utah

SELLING FOR CUSTOMERS

1000 KW, 2300 volt Gen. Elec. REBUILT condensing turbine 175 S.P.
300 KW 240 V Westinghouse geared Noncond. turbine
400 KW 480 V 1200 RPM Elliott generator with 1200/4500 gear
285 KVA 240 V Chase inflow engine set.
2000 Amp. 3-pole GE Air breaker with Bus Duct.
300 & 200 KW Syn M.G. Set with control.

H. BLANE JOHNSON & ASSOCIATES
53 W. JACKSON BLVD., CHICAGO 4, ILL.

2—ELLIOT TURBINE GENERATOR SETS

Gen.: 250 KVA 3/60/208V .8PF 1200 R.P.M.
Turbo: Non. cond. 200 lbs. P.R. 100 Super heat. 5 lbs. Exh. 5000 R.P.M. 284 H.P.
NOTE: ABOVE ARE COMPLETE WITH SWITCHBOARD AND EQUAL TO NEW. IMMEDIATE SHIPMENT.

ALBERT HELLER CO. HYacinth 5-0800
210 Snediker Ave., Bklyn 7, N. Y.

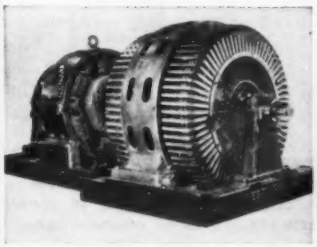
IT ISN'T RE-NU-BILT UNLESS

It Comes from

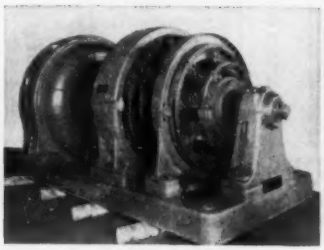
BELYEA

"SUCCESSFUL OPERATION GUARANTEED"

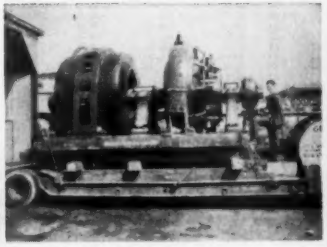
Three Recent Stock Arrivals



500 KW-MG



750 KW-MG



2000 KW-MG

MOTOR GENERATOR SETS

3 ph. 60 cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
2	2000*	G.E.	500		6600/11000
1	1800	G.E.	600	125/250	4000
1	1500	Whse.	600	600	2300/4600
1	1500	G.E.	360	275	2200/4400
1	1000	Whse.	900	600	2300/4150
1	1000	West.	514	250	4150
1	1000	G E.	900	600	2300/4150
1	800	Whse(3U)	1200	600	2300
1	750	Whse.	900	250	2300
1	500	G.E.	720	125	2300/4000
1	500	Whse.	900	250	440
1	400	G E.	720	250	440/2300
1	400	G E.	1200	120/240	440
1	400	Whse.	1200	250	2300
1	250	G.E.	900	125	2300/4150
1	150	G.E.	1200	250	2300
1	150	Whse.	1200	275	2200
1	150	Cr Wh.	1200	250	440
1	140(3U)	Cr. Wh.	690	125/250	2300
1	100	G.E.	1170	125	220
1	100	Delco	1200	125/250	440
1	75	G.E.	1200	125	4000
1	75	Cr. Wh.	1170	250	220/440
1	75	G.E.	1200	250	440
6	70	G.E.	1200	70	220/440
1	60	G.E.	1200	250	2300
1	50	Whse.	1200	120	220

* 25 Cycle

ROTARY CONVERTERS

60 Cycles

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	2000	G.E.	514	600	13800
1	1000	Whse.	900	600	11000
1	750	Whse.	900	600	13200

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	1000	G.E.	Condensing 125/150# ISP 2300/4150 V 3 ph. 60 cy.
2	750	G.E.	Condensing 425#-725°TT ISP-440V-3 ph. 60 cy. New—1944
1	625	Whse.	Non-condensing, 125/150# ISP, 5/20# B.P., 480 v., 3 ph., 60 cy., with exciter
1	400	Whse.	Non-condensing 125/150# ISP 5/10#BTU 46/480v. 3 ph. 60 cy.
2	400	G.E.	Condensing. 275# ISP. Geared to 1200 RPM. 120/240V. D.C. Generator.
1	300	G.E.	Non-condensing 150/175# ISP 5/15# B.P. 480V. 3 ph. 60 cy.
1	300	Al. Ch.	Condensing 425# ISP Geared to 1200 RPM 120/240V. D. C.
2	200	Cr. Wh.	Condensing 250# ISP GEARED to 1200 RPM—125V. D.C. Gen.
1	200	Whse.	Non-condensing 150# ISP 7# B.P. 240V. 3 ph. 60 cy.

D.C. MOTORS

HP	Make	Type	Volts	Speed
1—1750	Whse.		600	525/720
1—1500	Whse.		525	600
1— 940	Whse.	QM-R.Brg.	250	140/170
1— 800/1000	Whse.		450	600/720
1— 650	G.E.	MPC	250	115/145
1— 600	Al. Ch.	MILL	230	400/800
1— 300/400	G.E.	DYNA	250	1325/2500
1— 250	Cr. Wh.	CCM-151H	230	1100
1— 235	Whse.	MQ	250	300/900
1— 200/300	G.E.	MPC	230	360/920
1— 275	Whse.	QM-600-6	230	425/850
1— 250	G.E.	MPC	230	400/500
1— 150	G.E.		600	250/750
10— 150	Cr. Wh.	83H	230	890
1— 150	Cr. Wh.	CMC-65H	230	1150
1— 150	Cr. Wh.	CCM-152H	230	300/1050
1— 50/120	G.E.	MCF	230	250/1000

FREQUENCY CHANGERS

1—1000	A.C.	25/62½		2300/2300
1—1000	G.E.	25/58	Cycle	4100/2300
1— 500	A.C.	25/60	Cycle	11000/2300V

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Type	Volts	Speed
1	5140	Whse.		4150	600
1	4000	G.E.	TSC	2400/4800	900
1	2000	Whse.		4800	720

TRANSFORMERS

60 Cycles

Qu.	KVA.	Make	Type	Ph.	Voltages
3	2666	Whse.	OISC	1	6600/11000
3	1250	G.E.	H	1	6600x500
1	1050	G.E.	WCTH	3	11000x445
1	600	Al.Ch.	OISC	3	4000/2300x216
1	500	Whse.	OISC	1	34650x482
3	333	Maloney	C	1	7620/13200x120/240
3	333	Pitts.	OISC	1	26400x2600
6	250	G.E.	HT	3	13200x240/480
3	250	G.E.	HT	3	6900x240/480
9	250	G.E.	HT	3	2400x240/480
6	250	G.E.	HS	1	8900x240/480
12	250	G.E.	HS	1	2400x240/480
3	150	Maloney	OISC	1	13800x2*00/1600
1	100	G.E.	H	1	450x220

RECTIFIERS

1— 750	G.E.	BHW	575	2300
1—1000	A.C.	B-612	625	13500
1—1000*	A.B.B.	GRZ	625	6600/13200

*This unit with full automatic control good for both 25 and 60 cycle.

A. C. MOTORS

3 ph. 60 cycle

SYNCHRONOUS

HP	Make	Type	Volts	Speed
3—3500	G.E.	TS	2300	257
1—2100	G.E.	ATI	4600	514
2—2000	Whse.		2300	120
1—1470	Whse.		4600	900
2— 900	Al. Ch.	(New)	2300	150
1— 650	Whse.	G	2200	138
1— 600	Whse.	Syn.	440	900
1— 450	Whse.	Eng.	2200	128.5
2— 350	G.E.	TS	2200	150
1— 300	G.E.	ATI	440	720
1— 300	Whse.		2300	720
1— 225	G.E.	ATI 1-Brg.	440	900
1— 125	G.E.	ATI	440	450
1— 100	Whse.		550	600

SLIP RING

1—1000	Whse.	CW	2300	444
1— 700	Whse.	CW	2300	900
1— 500	G.E.	IP	550	505
1— 500	G.E.	IM-Mill	2200	450
1— 350	G.E.	MT-442-Y	2200/1000	253
1— 300	Al. Ch.	3 Brg.	2300	505
1— 300	G.E.	IM	440	720
1— 300	Al. Chal.	ANY	2200	708
1— 250	Al. Chal.	ANY	440	565
1— 250	G.E.	M-567-TEFC	440	600
1— 250	G.E.	MT-424Y	4000	257
1— 250	G.E.	MT-559S	2200	1750
1— 250	Al. Chal	ANY	550	600
1— 200	Al. Ch.	ANY	440	440
3— 150	G.E.	IM-15	440	695
2— 150	Al. Chal.	ANY	440	580
4— 125	G.E.	MT-566Y	440/2200	435
4— 100	G.E.	MT-566Y	440/2200	425
2— 100	G.E.	TM-16	2200	435
2— 100	G.E.	IM	440	690
3— 100	Al. Ch.	ANY	440	695

SQUIRREL CAGE

2— 650	G.E.	FT5503Y	440	3570
2— 450	Whse.	CS	2300/4150	354
1— 200	G.E.	IK	550	865
1— 200	G.E.	T-357	440	1800
1 —200/112	G.E.	KF-559B8	440	1170/885
1— 150	Wstghse.	CS8568	440	880
1— 200	G.E.	IK	440	600
1— 125	Whse.	MS	440	485
1— 125	(New) G.E	KF-TEFC	440	1190
1— 125	G.E.	KF-TEFC	440	3585
3— 125	Al. Ch.	ARW	2300	1750
1— 125	G.E.	IK	220	900
1— 100	Al. Ch.	AR	2300	1170
1— 100	G.E.	IK-Vert.	2300	450
2— 100	G E.	KT-541	220/440	1750
3— 75	G.E.	KT547Y	2200	1160

RE NU BILT BELYEA MOTORS

BELYEA COMPANY, Inc.

43 HOWELL ST., JERSEY CITY, N. J.

PHONE - JOURNAL SQUARE 2-3334

N. Y. LINE - RECTOR 2-7150

220/440 Volt, 60 cycle **SQUIRREL CAGE** open, 3 Phase

GUARANTEED REBUILT

QN.	HP	MAKE	TYPE	BEARING	SPEED
1	200	G.E.	IK	S.B.	900
1	200	G.E.	IK	S.B.	720
1	150	G.E.	IK	S.B.	600
1	150	G.E.	IK	S.B.	720
1	150	G.E.	IK	S.B.	1800
2	125	Kilby		S.B.*	1800
1	100	West.	MS	S.B.	1200
1	100	West.	CS	S.B.	720
3	100	G.E.	IK	S.B.	720
1	100	G.E.	KT-347	S.B.	1200
2	100	G.E.	IK	S.B.	900
1	100	G.E.	IK	S.B.	1800†
3	100	G.E.	IK	S.B.	1800
1	100	West.	CS-504	S.B.	1800
1	75	G.E.	IK	S.B.	600
2	75	G.E.	IK	S.B.	720
2	75	West.	CS-732C	S.B.	600
1	75	G.E.	K-505	S.B.	1200
1	75	G.E.	IK	S.B.	900†
3	75	G.E.	IK	S.B.	900
2	75	West.	CS	S.B.	1200
4	75	G.E.	IK	S.B.	1200
2	75	F.M.	QS-445	S.B.	1800

QN.	HP	MAKE	TYPE	BEARING	SPEED
2	75	G.E.	IK	S.B.	1800
1	60	G.E.	KT-346	S.B.	900
1	60	G.E.	IK	S.B.	1200
1	60	F.M.	QS-444	S.B.	1800
1	60	G.E.	KT-333	S.B.	1800
4	60	G.E.	IK	S.B.	1800
1	50	G.E.	IK	S.B.	600
3	50	West.	CS	S.B.	900
1	50	G.E.	KT-342	S.B.	900
1	50	G.E.	KT-342	S.B.	900†
2	50	West.	CS-445	S.B.	1200
1	50	G.E.	KT-327	S.B.	1800
2	50	G.E.	IK	S.B.	1800†
3	50	G.E.	IK	S.B.	1800
1	40	G.E.	KT-542	S.B.	720
1	40	F.M.	BH12D	S.B.	900
1	40	G.E.	KT-338	S.B.	900
1	40	West.	CS	S.B.	1200
2	40	G.E.	IK	S.B.	1800†
2	40	G.E.	IK	S.B.	1800
1	35	G.E.	IK	S.B.	720
1	30	Triumph	BI2	S.B.	900
5	30	G.E.	KT-312	S.B.	1800

QN.	HP	MAKE	TYPE	BEARING	SPEED
3	30	G.E.	IK	S.B.	1800
5	30	West.	K-365	S.B.*	3600
1	25	G.E.	IK	S.B.	720
1	25	F.M.	BI2P	S.B.	720
1	25	Century	SC-30	S.B.	1200
1	25	F.M.	BH12A	S.B.	1200
1	25	Ideal	A 18	S.B.	1200
1	25	West.	CS-471	S.B.	1800
1	20	F.M.	KBV	S.B.	1200
1	20	G.E.	KT-322	S.B.	1200
1	20	G.E.	KT-312	S.B.	1200
1	20	G.E.	K-364	S.B.	1800
1	20	West.	CS-364	S.B.	1800
2	20	G.E.	K-328	S.B.	3600
4	20	Line-Weld	Frame 320	S.B.	3600
2	15	West.	CS	S.B.	720
1	15	Wagner	15 T	S.B.	1200
1	15	Ideal	A	S.B.	1200
1	•15	G.E.	KT-502	S.B.	1200
1	15	G.E.	KT-752	S.B.	1800
1	10	G.E.	IK	S.B.	1200
1	10	G.E.	KT-752	S.B.	1200

* Splash proof † 2200 volt

SLIP RING MOTORS

We offer from stock the following 220/440 volt, 60 cycle, 3 phase, GUARANTEED REBUILT equipment, unless otherwise noted.

QUAN.	H.P.	MAKE	TYPE	SPEED	DESCRIPTION
1	15	G.E.	MT 512	900	S.B.
1	30	G.E.	MT 532	900	
1	30	Al. Ch.	ANY	900	
2	40	Al. Ch.	ARY 444	1800	splash proof, S.B.
1	40	G.E.	MT 536	900	S.B.
1	50	G.E.	I-M	900	S.B.
2	60	G.E.	MT 556	600	
1	60	G.E.	MT 546	900	
1	60	G.E.	I-M	900	
1	60	West.	CW 505	1200	
1	75	G.E.	I-M	720	
1	100	G.E.	I-M	720	
1	100	G.E.	I-M	900	
1	125	G.E.	I-M	720	
1	150	G.E.	I-M	900	
1	150	G.E.	I-M	1800	2300 volt
1	200	G.E.	I-M	900	

TOTALLY ENCLOSED MOTORS

FAN COOLED, BALL BEARING, 220/440 volt, 60 cycle, 3 phase, GUARAIITEED REBUILT, unless otherwise noted.

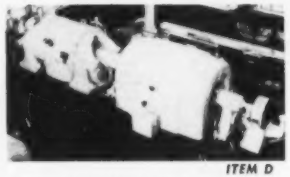
QUAN.	H.P.	MAKE	TYPE	SPEED	DESCRIPTION
1	7½	G.E.	KF 254	1800	
1	7½	Reliance	AA 324	1200	XP, NEW
3	10	L.A.	JS 329	1200	
1	15	West.	CS 328	1800	XP, NEW
1	25	L.A.	JS 384	1800	
1	40	G.E.	K 405	1800	XP, NEW
1	50	Master	FB 404	3600	XP, NEW
1	50	Al. Ch.	ARZZ 444	1800	NEW
1	75	G.E.	K 505	1200	

POWER EQUIPMENT COMPANY

8 CAIRN STREET — P. O. BOX 534 — ROCHESTER 2, N. Y.

Telephone: Genesee 5629

UTILITY AND INDUSTRIAL POWER EQUIPMENT



ITEM D

TURBO GENERATORS CONDENSING

A. 20,000 KW G.E. (1921) 235# 550°. 60/-3/13200 v. Turbine rebuilt. 11#/KWH

B. 10,000 KW (1929) 185# 500°. 60/3/2400 v. Very good condition

C. (2) 4000 KW (1934) 200# 600°. 60/3/-2400 v. Excellent; jet condensers.

D. 6000 KVA Wemco 250# 500°. 60/3/-2400 v. Rebuilt 1930. Utility maintenance. Beautiful condition.

E. (2) 1750 KW (1945) 525# 750°. Will re-wind. Six months operation

F. (2) 2500 KW GE (1928) 250# 550°. 60/3/6600. Complete Power Plant

DIRECT CURRENT

G. 500 KW Wemco (1930) 125/250 ISP—10/20 BP 250 volt. Good condition.

ENGINE GENERATORS—UNAFLOW

H. (3) 250 KW, (1) 175 KW Skinner (1) 250 KW—Ames—240/480 AC.

BOILERS

I. (2) 31,000#/hr Stirling (1937) 180#. Underfeed stokers.

J. (2) 310 HP Stirling (1936) 200#. Underfeed stokers

K. (2) Ohio Standard Brownell (1941) 338 sq. ft. H.S. Gas fired. 15 PSI. 1400#/hr.

FREQUENCY CHANGERS

L. 5000 KVA. (1928) Motor: 5800 HP 60/3/-11000 v. Generator: 5000 KVA 25/3/6600 v. Complete. Excellent.

M. 500 KVA 25 to 60 cycle

N. 1000 KVA 25 to 60 cycle

O. 2500 KVA start either end.

ROTARIES

P. 500 to 2000 KVA 250-600 volt

MG'S

Q. 500 to 2000 KW 250-600 volt.

PAUL STEWART

320 First Nat'l Bank Bldg. Norwood • Elmhurst 1610 • Cincinnati, Ohio

MOTOR GENERATOR SETS

125 K.W. 250 Volt D.C. Burke 440 Volt 3 phase 60 cycle 900 RPM Synchronous Motor.

100 K.W. 250 Volt D.C. Gen. Elec. 3 brg. 440 Volt 3 phase 60 cycle 900 RPM. Synchronous Motor.

50 K.W. 250 Volt D.C. Westing. 4 brg. 220/440 Volt 3 phase 60 cycle 120 RPM motor.

20 K.W. 125 volt D.C. Allis Chalmers 3 brg. 440 volt 3 phase 60 cycle 1800 RPM motor.

D. C. GENERATORS

100 K.W. 230 volts 1200 RPM Westinghouse SK

75 K.W. 250 volts 600 RPM Westinghouse SK

MOTOR REPAIR & MFG. CO.

1557 Hamilton Ave., Cleveland, Ohio

BOILERS

10 to 1000 H. P.

NEW-USED RECONDITIONED

Steam, Gas and Electric Power Equipment

J. PARKER THOMPSON CO., INC.

507 FIFTH AVE., NEW YORK CITY

MURRAY HILL 7-0347-8-9

WORLD'S LARGEST INVENTORY

Established 1934 — D & B Rated

ELECTRIC EQUIPMENT CO., ROCHESTER, N.Y.—FEBRUARY BULLETIN

MOTOR GENERATOR SETS AC — DC

Quan.	KW	Make	Volts
1	1000	General Electric	250
6	1000	General Electric	600
2	500	Westinghouse	250
2	500	Westinghouse	1500
1	500	Westinghouse	125
1	400	Westinghouse	125/250
2	300	General Electric	125/250
1	300	General Electric	500
1	250	General Electric	250
1	200	Westinghouse	250
1	200	General Electric	250
2	200	General Electric	125
1	150	General Electric	250
1	150	General Electric	125
3	100	General Electric	125
4	100	General Electric	250
1	100	Allis-Chalmers	125/250

Plus 238 sets from 1 KW to 75 KW in stock.

DC TO AC

Input	Output
1 300 HP—230 V	200 KW, 440/60/3
1 125 HP—230 V	75 KW, 125 V, DC
1 25 HP—230 V	15 KW, 230/60/3
1 25 HP—230 V	15 KVA, 230/60/1
35 20 HP—230 V	12½ KVA, 440 V, 3 ph, .8 P. F.
40 7½ HP—230 V	7½ KVA, 120/60/1
20 6 HP—115 V	5 KW, 120/60/1
5 3 HP—115 V	2 KVA, 110/25/1
10 1½ HP—115 V	1 KVA, 110/60/1
10 1 HP—115 V	½ KVA, 110/60/1

ROTARY CONVERTORS

Quan.	KW	Make	Speed	Volts
5	500	General Electric	1200	250
7	400	Westinghouse	1200	250
1	100	General Electric	1200	250

P.S.—We Stock Explosion-Proof Motors—Class 1-D & 2-G

AC GENERATORS—ALTERNATORS—CONDENSERS

Quan.	KVA-HP	RPM	CYCLE
1	2500	720	60
1	2500	900	60
1	1675	600	40
2	1500	900	60
1	1430	514	60
1	1250	1200	60
1	1000	750	25
1	800	900	60
3	750	900	60
2	650	150	60
1	500	720	60
1	500	750	25
1	400	450	60
3	400	1800	60
1	350	750	25
1	350	720	60
1	350	225	60
1	333	1800	960
1	320	1200	120
1	300	750	25
1	300	180	60
1	250	720	60

Plus 78 smaller units from 3 KVA to 200 KVA

60 CYCLE MOTORS

SQUIRREL CAGE MOTORS

HP	SPEED	MAKE
500	720	G. E.
400	1200	West.
400	514	West.
300	600	West.
250	3600	G. E.
250	1200	G. E.
200	600	Al. Ch.
200	1800	Wagner
150	720	G. E.
150	600	G. E.
150	1200	Al. Ch.
150	1800	Al. Ch.
125	900	G. E.
100	900	West.

P.S. We stock 3500 new and rebuilt 1 HP to 100 HP

SLIP RING MOTORS

Quan.	HP	Speed	Make
1	600	1800	G. E.
1	500	1800	G. E.
1	500	514	Al. Ch.
4	500	900	G. E.
1	350	720	G. E.
1	300	450	G. E.
1	300	514	G. E.
1	300	900	G. E.
1	300	720	G. E.
1	200	600	G. E.
1	200	1200	G. E.
2	150	720	G. E.
1	125	1200	Al. Ch.
1	100	900	Wagner
4	100	450	G. E.
3	75	720	West.
6	75	900	West.
2	60	1800	G. E.
8	50	900	Cr. Wh.

Plus 837 smaller units 1 HP to 40 HP

FEBRUARY SPECIAL!
FREQUENCY CHANGER SETS
1 KVA to 1000 KVA IN STOCK

TRANSFORMERS

Quan.	KVA	Primary Volts	Secondary Volts	Phase
2	3000	23,000	2300	3
1	1500	2,300	600	3
1	1000	2,300	220	3
6	1000	66,000	7200	1
3	750	2,400	480	1
6	500	2,400	480	1
3	500	12,000	2300	1
3	450	23,000	440	1
2	333	2,400	600	1
3	333	2,400	240/480	1
3	333	13,200	240/480	1
3	333	11,500	240/480	1
3	300	2,400	120/240	1
6	250	2,400	240/480	1
3	250	4,150	120/240	1
5	200	2,400	240/480	1
3	150	2,400	240/480	1

Plus 734 smaller units 1 KVA to 100 KVA

You Can Rent Any Equipment In Our Stock
We Will Buy For Cash, Your Surplus Or Swap

DC MOTORS

ADJUSTABLE SPEED—230 VOLT

Quan.	HP	Make	Volts
1	300	General Electric	400/800
1	250	West.	250/675
4	40/250	West.	540/3000
1	150	West.	300/900
1	100	Reliance	500/1500
1	100	G. E.	400/1000
1	100	West.	450/1350
1	100	G. E.	1050/4000
1	90	F. M.	500/1500
1	75	G. E.	400/1200
1	60	G. E.	220/1000
1	60	G. E.	300/1200
1	50	G. E.	250/1000
1	50	G. E.	400/1200
1	40	G. E.	250/1000
1	40	Cr. Wh.	400/1600
1	35	West.	250/1000
1	35	G. E.	500/1000
1	30	Reliance	400/1200
1	30	Cr. Wh.	500/1500
1	25	Reliance	400/1600

Plus 327 smaller units 1 HP to 30 HP

CONSTANT SPEED—230 VOLT

HP OR KW	MAKE	SPEED
400 HP	Elec. Dyn.	1500
300 KW	G. E. (170 V)	1200
300 HP	Cr. Wh.	1200
250 KW	Al. Ch.	720
150 KW	West.	720
125 HP	Star	1200
100 HP	G. E.	900
75 HP	G. E.	1200
75 KW	G. E. 325 V	1200
50 HP	West.	1200
50 HP	Burke	1800

Plus 675 smaller units 1 HP to 40 HP also 115 V & 550 V, DC. We stock 110V. & 600V. Motors.

SQUIRREL CAGE AND SLIP RING—25 CYCLE

Quan.	HP	Speed	Make
1	650	365 rpm	S.R.
1	350	750	S.C.
1	300	750	S.C.
1	300	375	S.R.
4	200	500	S.R.
1	200	750	S.R.
1	200	750	S.C.
1	200	500	S.C.
1	200	1500	S.C.

Plus 872 smaller units 1 HP to 150 HP

COMPRESSORS

1—3000 CFM	Ingersoll—Steam
1—3000 CFM	Sullivan
1—1350 CFM	Ingersoll
2— 850 CFM	Ingersoll
2— 400 CFM	Chicago
2— 196 CFM	Ingersoll

We stock new units 6 CFM to 290 CFM

Note: We Stock 6000 New Motors, Controls, Frequency Changers

SEND US YOUR INQUIRIES!

ELECTRIC EQUIPMENT COMPANY

PHONE LD65

New and Rebuilt — ROCHESTER, N. Y. — 1 H. P. to 2500 H. P.

MOTORS — MG SETS — TRANSFORMERS — CONTROLS — COMPRESSORS

Our 30th Year

HEMPHILL EQUIPMENT PROVES ITS VALUE

Member of The National Industrial Service Association, Inc.

TRANSFORMERS—60 Cycle

Qu.	KVA	MAKE	TYPE	Ph.	VOLTAGES
1	1000	GE	Pyranol	3	4150 x 2400
1	1000	GE	Auto	3/2	4150 x 2400
1	1000	GE	Auto	3	3810Y-2200Y
1	800	Kuhl.	OISC	1	4600 x 2300V
3	400	GE	H	1	6900 x 2250V
1	300	Pitts.	ODSC	1	7800 x 440V
3	250	Maloney		13	800 pri., 220/440 sec.
1	200	Whse.	Auto	3/2	4150 x 2300
1	200	Pitts.	OISC	1	4000 x 110/220
1	200	GE	Auto	3/2	4150 x 2400
1	150	GE	KS	1	2300 x 230
1	100	Pitts.		1	2750 x 110/220
3	100	Wagner	RCKV	1	240 x 120/120
2	100	Whse.	SK	1	4400 x 220/440 Taps
3	100	Newark	Dry	3/2	440 x 220

MOTOR GENERATOR SETS
3 Phase, 60 Cycle

Qu.	KW	MAKE	SPEED	DC	AC
3	1500	GE	600	275	4000 Syn.
1	1000	GE	514	600	4000 Syn.
1	1000	GE	514	600	2300/4150 Syn.
1	300	GE	1200	250	2300 Syn.
1	150	GE	1200	125/	
1	150	Whse.	600	125	4150 Syn.
1	125	CW	1200	125	2300 SC
1	100	CW	1200	125	220/440 SC
1	100	El.Mach.	1200	125	4150 Syn.
2	75	GE	1200	250	220/440
2	75	GE	1200	125	220/440 SC
6	75	GE	1200	60	220/440 SC
1	50	Ridgway	1200	550	220/440 SC
1	50	Whse.	900	260	220/440 SC
2	40	El.Mach.	1750	125	440 SC

SLIP RING

1	2500	GE	MT	6600	257
1	300	Whse.	CW	440	600
1	250	Whse.	CW	440	600
1	200	Whse.	CW	440	600
1	100	GE	IM	440	400
1	75	GE	MT	220	1200 Vert
1	75	GE	MT	440	900
1	60	GE	MT	220	1750
1	60	GE	MT	440	900
1	50	GE	MT	220	1730
1	50	GE	MT	220	1200
1	50	Whse.	CW	220	900
1	50	GE	MT	220	1700
1	50	GE	MT	220	800
1	40	GE	MT	220	1200
1	40	GE	MT	2200	1200

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PHONE NEW YORK — LONGACRE 5-3227
PHONE NEW JERSEY — UNION 3-2600

This Seal is *Your Guarantee*

Quality SINCE 1906

Wente Motors

WIDE SELECTION UNUSUAL VALUES

THEIR ELECTRICAL CONSTRUCTION HAS BEEN REBUILT... BY EXPERTS

SQUIRREL CAGE
3 ph.—60 cy.—220 or 440 V.
(Other voltage as noted)

Qu.	HP	Make	Type	Speed
1	50	G.E.	I (2300 V.)	900
2	50	Al. Ch.		900
1	60	G.E.	RT Vert.	1800
4	60	G.E.	KT (2200 V.)	1200
4	60	G.E.	KT547Y (2200 V.) SP	1200
1	60	West.	CS (TEFCBB)	1200
1	75	West.	CS (TEFCBB)	1160
1	60	West.	CS Gearhead	532
1	100	G.E.	KT (2200 V.)	900
4	100	G.E.	K (TEFCBB)	1200
1	110	G.E.	KTP	1200
1	120	G.E.	PT	3600
2	125	Al. Wh.	AR (BB)	450
2	150	G.E. Ch.		1750
1	250	G.E.	KF (Vert.)	3600

SLIP RING—SYNCHRONOUS
3 ph.—60 cy.—220 or 440 V.
(Other voltage as noted)

1	50	Ideal	AV	600
1	50	G.E.	I	720
1	60	Ideal	AVX	1200
1	70	KW G.E.	TS (.7PF)	1200
1	75	West.	CW	400
1	75	G.E.	I	529
1	75	Fr.Morse	BV (2200 V.)	1800
4	100	G.E.	I-16 (2200 V.)	450
1	100	KW G.E.	ATB (SPP)	900
4	100	G.E.	MT546Y(2300V.)SP	450
1	100	G.E.	MT550	900

Qu.	HP	Make	Type	Speed
1	125	Fr.Morse	T (2400 V.) (PF1.0)	900
1	150	West.	CW	450
1	200	West.	CW (3 Bear.)	600
1	625	Kva R.M.	(.8 PF)	900

D.C.—230 VOLT
(Other voltage as noted)

1	50	West.	SK	350
2	50	Reliance	T	2700
1	50	West.	SK (115 V.)	500
1	60	West.	SK (115 V.)	500/1500
1	75	Diehl	K11	700
2	75/100	Reliance	T1050	300/900
2	75	West.	SK, frame 165	850
1	100	West.	SK, frame 180	1200
1	100	Cr. Wh.	CM	600
1	130	Cr. Wh.	CMC (550 V.)	1200
1	150	West.	SK	400/1200
1	150	West.	SK	350
1	200	Cr. Wh.	CMC	450
2	200	Reliance	T2550	300/900
2	200	G.E.	TLC-74	1350/4000
1	250	West.	SK	1050

M-G SETS

1— 45 KW West. 60 V DC—440 V AC 1200 RPM
4— 60 KW G.E. 60 V DC—440 V AC 1200 RPM
2— 75 KW El. Prod. 220 V DC—440 V AC 1200
1—100 KW West. 250 V DC — 440 V AC 1200
1—100 KW West. 250 V DC — 440 V AC 900
1—100 KW Reliance 250 V DC — 220 V AC 1200
1—100 KW Ridge 275 V DC — 440 V AC 1200
1—150 KW G.E. 275 V DC — 440 V AC 900

ALSO—4000 motors other than listed from 1 HP to 300 HP.

The Wente Electric Co.,

Hamilton 203 NO. FOURTH ST. Phone 4-8128 *Ohio*

1500 KVA FREQUENCY CHANGERS
2100 HP 3/60/2300, 360 RPM
1500 KVA 3/30/460, 360 RPM
Complete Controls
ALL G. E. ATI & ATB
WILL SELL MOTORS OR GENERATORS SEPARATELY

2100 HP SYNCHRONOUS MOTORS
G. E. ATI-C UNITY PF, 3/60/2300
360 RPM TWO BEAR. PED.
RED, VOLTAGE MANUAL CONTROL

1500 KVA AC GENERATORS
G. E. ATB-C 80% PF 3/30/460
360 RPM, SINGLE BEAR.
COMPLETE CONTROL PANELS

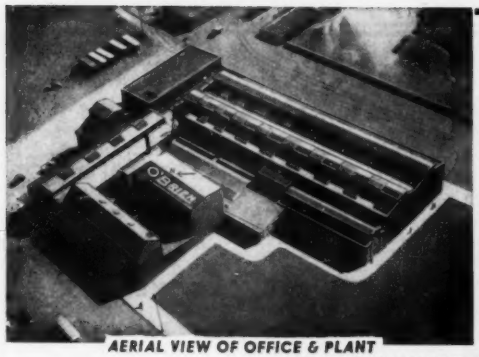
S. M. DAVIS
510 LaSalle St. St. Louis 4, Mo.

FOR SALE

1000 KW Westinghouse Turbine; 3 ph-60 cy 2300 volt; 180# Steam pressure; 50° Superheat; straight condensing. Worthington vacuum pump included. Available immediately.

Ingersoll-Rand Class PRE 25x15¾x18 air compressor; 270 HP synchronous motor; 3 ph-60 cy-440 volts. Complete with starting gear exciter and spare parts. Tip-top shape. *Available immediately.*

EVANS PRODUCTS COMPANY
Western Division, Coos Bay, Oregon



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***Get the best!* Good machinery, properly reconditioned and fully guaranteed. Here are a few representative items from stock.**

1547 N. DELAWARE AVE., PHILADELPHIA, PA.

PRR Siding—35 ton OET Crane Capacity

ELECTRIC MOTORS

3 PHASE — 60 CYCLE

Q.	HP	Make	Type	Volts	Speed
1	1200	Cr. Wh.	Sl. Rg.	2300	257
1	650	G.E.	TS(Syn)	440	360
2	600	West.	Syn.	440	257
1	400	West.	CW	440	514
1	350	West.	CW	440	600
1	315	G.E.	Syn.	2200	720
1	250	West.	CS	2200 (25 cyc)	375
1	250	West.	CS	2300	1200
2	200	E.M.	Syn.	4160	600
1	200	West.	MW	440	600
1	150	Ideal	Syn.	220	1200
1	150	El. Mch.	Syn.	220	900
1	125	Cent.	SC	440	1800
2	100	West.	CS	220	1800
1	100	Cent.	SC	220	1200
2	75	Cent.	SC	440	1200
1	75	West.	CW	440	1200
1	60	Ideal	SC	220	1200
1	60	West.	C.W.	440	720
1	50	West.	C.W.	220	900
1	50	G.E.	I.M.	440	600
2	50	Cent.	SC	220	1200
1	40	G.E.	MT-536	440	900
1	30	G.E.	MT-532	440	900
2	25	G.E.	MT-332	440	900
1	100	West.	SK183	230V. D.C.	400/1200
1	50	Cr. Wh.	CMC	230V. D.C.	300/1200

MOTOR GENERATOR SETS

1—1000KW GE MPC ATI 550v. 3/60/2300

1— 500KW GE MPC ATI 250v. 3/60/2300/720

1— 750 KW G.E. 250v. 3/60/2300 volt

1— 200KW West. 250v. 3/60/2300 volt, 1200 rpm

1— 200KW West. 250v. 3/60/220-440/1200 rpm

1— 100KW G.E. 125 3/60/220/1200 rpm Syn.

1— 80KW G.E., 240v. 3/60/440/1800 rpm

1— 50KW G.E. 250v. 3/60/240/1200 rpm

1— 50KW G.E. 125 volt, 3/60/220/1200 rpm

1— 40KW Ideal, 125 volt, 3/60/220/1200 rpm

1— 40KW West. 240v. 3/60/220-440/1200 rpm synchronous

3—7½KW G.E., 60v. 3/60/220-440 volt

AIR COMPRESSORS

3—12,000 CFM Ingersoll Rand Turbo Compressors 3.25# pressure, 250 HP 3/60/440/3600 rpm motor drive.

1—3000CFM Sullivan Angle Compound 100 psi, 500 HP Syn. M.D. 3/60/2300

1—1050CFM Worthington, 18x11x14 100 psi, 257 RPM, Belted

1—1050CFM Ingersoll-Rand ES-1, 17¾x13, 50 psi, 275 RPM, V-belt

1—880 Worthington 17x10½x12 synchronous Motor drive 150 HP 3/60/440

1—734CFM Sullivan Angle Class W13, Single Stage 13x13x8, 60 Lb., 300 RPM, v-belt, 100 HP

2—528 CFM Chicago NSB, 100 Lb., 285 RPM, V-belt, 14x12

2—368CFM Ingersoll ER-1, 285 RPM, 100 psi., 50 HP direct gear, M.D., 3/60/220

1—277CFM Chicago PB4 Air Cooled 50 HP V-Belt Motor Drive

1—229CFM NEW Chicago PB 4 Air Cooled, 870 RPM, 125 Lb., V-belted, 50 HP, M.D.

1—245CFM IR-10x10 ER-1, 125 Lb.

1—215CFM Penna. 3A—10x8, 50 Lb.

1—211CFM NEW Chicago 9x9 T-B Horizontal 100 psi, V-belt

2—173CFM Ingersoll ER-1, 9x8, 300 RPM, 100 LB., V-belt

DIESEL GENERATORS

1—2500KVA General Motors, complete plant, 3/60/2300 with 2300 to 230/460 transformers, cooling system, starting equipment, switchboard, can demonstrate on foundations. Immediately available.

1—225 KVA Gen. Motors Twin 6-71, 3/60/440, NEW 1941

200KW Fairbanks Morse, 250v., D.C. 720 rpm 8 cylinder, 4 cycle, Complete—1940

200KW G.E.-Fairbanks Morse, 720 rpm, 3/60/220/440—8 cyl., 4 cycle—1940

200KVA Cummins LI 400 3/60/440/900 rpm—Radiator—Sw. Bd.

100KVA Cooper Bessemer 8 cy 900 rpm, 3/60/220

56KVA G.E.-Climax Gasoline Portable, 3/60/220/1200 rpm

40KVA NEW Chrysler 3/60/220—2 units

30KW Buda, 3/60/220/1200 rpm

20KW Le Roi Gasoline—1/60/110-220 volt

TURBO-GENERATORS

1—625KW West. 3/60/2300/3600 RPM, 125 Lb. psi, 6 Lb. B.P.

1—600KW G.E. Extraction 360/2300/250 psi., 80 lb. & 16 lb. extraction. Surface Condenser new 1940.

1—400KW West. 3/60/480, 150 psi., 10 Lb. B.P.

1—300KW Elliott (New 1941) 250 Volt D.C., 150 Lb. I.S.P., 20 Lb. B.P.

1—300KW G.E. 3/60/2300/100 p.s.i. 0-15 Lb. B.P.

1—300KW G.E. 3/60/2300/3600 RPM, 175 psi, 8 Lb. B.P.

1—160KW West. 3/60/220/3600 RPM, 125 Lb. psi., 10 Lb. B.P.

1—160KW Ridgeway 4 Valve Steam Engine Generator, 3/60/220

1—100KW NEW 3/60/220 150/200 psi. 0/30 Lb. B.P.

1—35KW G.E. 125 volt D.C., 3600 RPM

PUMPS

Centrifugal and reciprocating pumps, large stocks —1" to 20". Advise requirements.

"Everything from a Pulley to a Powerhouse"

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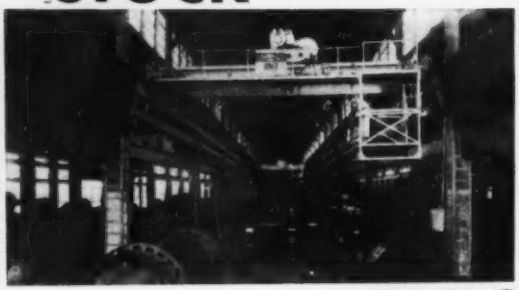


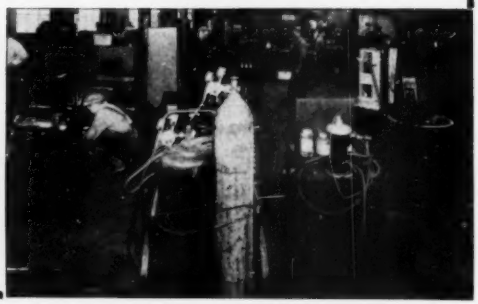
AC and DC Motors
AC and DC Generators
Motor-Generator Sets
Frequency Converters

PLUS **SHOP**

Means HELP To You

Please send your inquiries for electrical equipment to:

GLOW ELECTRIC CO.
927 HARRIET ST. CINCINNATI 3, OHIO
PHONE MAIN 3024



SPECIAL OFFER

Two complete turbo-generating units with complete structural steel base and supports.

GENERAL ELECTRIC A.C. GENERATOR Serials #135321 & #13536341, Type ATB, 2 KVA 1875, Speed 3600, Form "F", Amperes 164, KW 1500, Volts no load 6600, Volts full load 6600.

CURTIS STEAM TURBINE Serials #18967 & 18966, KW 1500, Speed 3600, Form "B", 3 stage, 200# Steam Pressure, Condensing: P.F. 80%.

CONDITION: These units were completely rebuilt in 1942, and only operated less than one year, as can be certificated by the General Electric Co. We guarantee them to be in good operating condition.

1—25 KVA GASOLINE GENERATOR Mfgr: Westinghouse, Leroi engine, 120 volts, 1 phase, 900 RPM.

3—25 KW DIESEL GENERATORS Mfgr: Westinghouse, 450 volts AC, 60 cycle, 3 phase, 42.8 Amps, direct connected to 50 HP Winton Diesel, 3 cylinder.

8—132 KW TURBO GENERATORS Mfgr: Westinghouse (4), General Electric (4), 450 volts AC, 60 cycle, 3 phase, 1200 RPM, 256 Amps, 375# steam pressure, complete with reduction gear and 40 KW exciter.

2—STEAM TURBINES Mfgr: Westinghouse, Serial Nos. 2-A-9229-133 & 134, 6819 RPM, 418 LB.G steam press, 18 LB.G back press, 7763 over speed test, 3100 S.H.P.

2—STEAM TURBINES Mfgr: Westinghouse, Serial Nos. 2-A-9230-133 & 134, 7797 RPM, 26 LB.G steam press, 25 IN. HG. back press, 8967 over speed test, 3100 S.H.P.

TRANSFORMERS

.5 KVA to 750 KVA.

BOILERS

1—188 h.p. bigelow 160 lb. wp 4 yrs. old.

1—150 h.p. Coatesville 150 lb. wp. 20 yrs. old.
Both units complete with modern automatic oil feed and firing systems.

ALSO 1—250 h.p. B&W 160 lb. wp.
2—400 h.p. B&W 135 lb. wp.
3—500 h.p. B&W 160 lb. wp.

We own and offer a complete line of refrigeration, chemical, processing, and power equipment.

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KAPLAN MACHINERY CO.
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COMPLETE DIESEL PLANT

3—700 HP Winton 8 cyl. 4 cycle, 360 RPM diesels. 500 KW Elec. Mchy. 3/60/2300 alternators. Switchboards and complete plant auxiliaries. For sale in whole or part. Condition excellent.

MISSISSIPPI VALLEY EQUIPMENT CO
507 Locust St. **St. Louis 1, Mo.**

FOR SALE

50 KW Electric Machinery Motor Generator Set, 250 Volts D.C., driven by Synchronous Motor.

ELECTRIC APPARATUS REPAIR CO.
1400 N. 6th St. **Phila. 22, Pa.**

500 HP Broe W.T. Boiler, Broe Sprdr. stkr. $7,000
500 HP Vogt W.T. Boiler, Firito Spr. stkr. $7,000
200 HP Vogt W.T. Boiler, Westghse Undf. " $4,500
210 HP Vogt W.T. Boiler, compl. new tubes $5,500
2—150 HP HRT boilers, shell only, $750 & $1,000
Westghse Underf. stkr. 114' gr., prac. new, $2,000

ALLIED EQUIPMENT COMPANY
Louisville, Ky.—950 Cherokee Rd., HI 2138
Woodside, L.I.—4205 48th Ave., IR 6-8776

100,000 Gallon Steel Water Tank & Tower
675 KVA Gen. dir. con. Non-R.C. Engine
1250—837—150 KVA Diesel Eng. Gen. Sets
210 HP 200# ASME Low-head WT Boiler
575 KW 240 V. Comb. Gas & Diesel Set
6'x40' Louisville Rotary Dryer

H. & P., 6719 Etzel, St. Louis 14, Mo.

POWER EQUIPMENT—READY TO SHIP

Qua.	H.P.	Make	RPM	Type
1	250	Burke	720	syn.
1 vert.	250	G.E.	1200	I
1	250	G.E.	1200	I-E-15A
5	250	Westg. (drip proof—CS-8758)	1775	2300 v.
1	200	Westg.	720	CS-954A
1	200	Westg.	860	I-E
5	200	Wagner	1750	RP-2
1	200	G.E.	1800	Syn.
2	175	Westg.	600	CS-945A
1	150	G.E.	700	K
1	150	Westg.	257	Syn.
1	150	Westg.	500	CS-954A
1	150	L. Allis	1775	spl. pr. BB
1	125	El. Mach.	164	Syn.
1	125	Westg.	450	CS-954A
4 New	125	Westg.	1200	Syn.
1	112	Westg.	1200	Syn.
1	100	A. Ch.	720	
1	100	Westg.	900	Syn.
1	100	Westg.	600	Syn.
1	75	G.E.	720	I-E
1	75	Stanley	600	
1	75	Al. Ch.	585	
1	75	G.E.	514	I-K
1	75	Westg	720	
1	75	El.Mchy.	900	Syn.
1 New	60	Rel'ce (2200 v.—TEFC)	880	C-5088
5 New	60	Westg. (TEFC)	900	CS-607
5 New	60	Westg. (explosion proof)	900	CS-607
1	60	G.E.	1800	KT-533
1	50	Triumph	860	
1	50	Westg.	1735	CS
5 New	50	G.E. (TEFC—2200 v.)	1750	K-504
1	50	Wagner	1750	CP-504
1	40	G.E.	3600	FT-513
1	40	Al. Ch.	1750	
1	40	Westg.	900	
1	40	Crker Wh.	720	
1	40	G.E.	570	
2	30	G.E.	3600	KT-305
1 New	30	L. Allis	1800/1200	
6	30	Al. Ch.	1750	
1	30	Al. Ch.	865	AR
1 New	30	Westg. (Hi-torque)	900	CS-445
1 New	30	G.E. (Hi-torque—splash proof)	900	KG-445
4	25	O'Nan	1800	Syn.
1	25	Howell (TEFC)	1800	K-365
1	25	G.E.	1200	K-F405
1	25	Westg.	1200	CS-405
1	25	Century	1150	Hi-torque
2	25/7.5 Cont'l		1150/575	
1	25/6.2 Cont'l		1150/575	
1	25	Rel'ce	720	C-445
1	20	Sterling	1800	KFT-364
1	20	G.E.	1750	K-364
2	20	Westg	1750	CS-364
1	20	G.E.	1800	KT-501
1	20	Howell	1200	BB
1	20	G.E.	1150	FT-522
5	20	Cr. Wh.	1150	6C
1	20	L. Allis (exp. proof)	870	EX-405
1	20/10	Al. Ch. (TEFC)	860/430	ARZ
1	20/7½	G.E. (TEFC)	1165/425	K-504
1 New	20	Rel'ce	580	C-445
1	12½	G.E.	1150	KT-382
1	15	U.S.	3600	SC-324
3	15	Westg.	1750	CS-326
1	15	L. Allis	1150/1740	BB
1 New	15	G.E.	1150	KG-364
1	15	G.E.	570	KT-326
3 vert.	10	G.E.	1750	K-324
2	10	Rel'ce	1730	AA-324
1	10/5	G.E.	1800/900	
13 New	5	G.E. (TEFC)	1150	K-284
50	5	Westg.	1150	CS
2	3	L. Allis	3450	TEFC
8	3	Westg	1760	TEFC
1 New	2	L. Allis	1800	224
6	2	Howell	1150	TEFC
25 New	1/2	Diehl	1725	TEFCBB

SPECIAL BARGAINS
Diesel Engine Generator Sets

5—200 kw. Westinghouse 220/440 v. 3 ph. 60 cy. General Motors Model 8-268 DIESELS

10—100 kw., 120/240 v. D.C. Delco Generators dir. con. to 150 HP Model GBD-8, 5½x7, 6 cyl. Superior DIESEL Engines, elec. start with engine panels

4—100 KW same as above with 220 or 440 v. NEW A.C. Generators

1—66 kva. Fairbanks Morse 220/440 v. 3 ph. 60 cy. 300 rpm DIESEL

2—75 kva. 220/440 v. 3 ph. 60 cy. Delco Cumming DIESEL

2—37½ kva., 220/440 v. 3 ph. 60 cy. Buda DIESEL

GEAR MOTOR BARGAIN

50 HP G. E. 1755 rpm input 13 rpm output speed 220/440 or 550 v. A.C. 3 ph. 60 cy. splash proof ball bearing.

A. C. GENERATORS—3 ph. 60 cy.

No.	Kva	Make	Rpm	Volts
6 NEW	100	West.	1200	220/440
3	25	Onan	1800	220/440

MOTOR GENERATOR SETS—
250 V. D.C.
Motors 220/440 volt or 2200 volt

No.	KW	Make	Rpm
2	200	Westinghouse	1200
1	100	Westinghouse	720
1	100	General Electric	900
1	100	Westinghouse	600
1	100	General Electric	1800
1	100	Reliance	600
1	100	Delco	1200

125 V. DC M.G. Sets

1—75 kw. West. 125 v. 1200 rpm. 220/440 v. 3 ph. 60 cy. Syn.

TRANSFORMERS—1 ph. 60 cy.

No.	Kva	Make	Pri.	Sec.
1	500	Standard	2300	575/460/345 220/115
3	500	G.E.	2300	230/460
6	333	Maloney	2300	230/460
3	200	West.	2300	230/460
1	100	Peerless	2300	230/460
3	75	Penna.	2300	115/230

ENGINES

NEW 75 HP. F.&H. Model 387C 3 cyl. Diesel
Rebuilt 22 HP. Caterpillar Model D-3400 Diesel
NEW 42 HP. International Model U-6 4 cyl.

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20—6000 cfm Sturtevant Bulletin 512389 3" stat. pres. 7 blade dir. con 5/1.5 HP 1765/1175 rpm 220/440 v. 3 ph. 60 cy. Westg. TEFC Motors.
5—5000 cfm 3.2" stat. pres. Sturtevant with 2 speed 220/440 v. 3 ph. 60 cy. Motors
3—10,000 cfm LADEL dir. con. 2 speed 220/440 v. 3 ph. 60 cy. Motors
1—12000 cfm 3" stat. pres. with 2 speed 220/440 v. 3 phase 60 cy. Motors
3—10000 cfm 3" stat. pres. Buffalo Forge with 2 speed 220/440 v. 3 ph. 60 cy. Motors
1—67000 to 38000 cfm 1" to 0.5" stat. pres. Size 50" dia. 7½" I. 2 sets propellers International Eng. Co. driven by 100 HP AC Motor

PLATING SETS

1—1000 amp. 25 v. G. E. driven by 40 HP 230 v. D.C. 1200 rpm mtr. (Like New).

SPECIAL BARGAIN
550 V. M.G. Sets

2—500 kw. Crocker Wheeler 575/600 v. 720 rpm., dir. con. 4160 or 2300 v. 3 ph. 60 cy. Syn. Motors with swbds.

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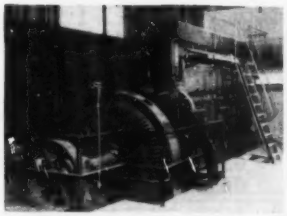

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2—30,000# B&W 450# superheat
1—1250 B&W Sectional header 200#—super
1—1000 HP Erie City Boiler, 200#
1—760 HP B&W Sectional header—Super
1—400 HP Erie City 200# (can ship assembled)
2—400 HP B&W Steel Sectional Header Boilers
Also smaller Boilers & Fire Tube Boilers

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2—10,000 KW Turbo-Generator—Cond.
1— 7,500 KW Turbo-Generator—Cond. 600#
1— 5,000 KVA Turbo-Generator 450# with condensing equipment
2— 5,000 KW Turbo-Generator—Cond
2— 3,000 KW Turbo-Gen. and Cond..one ext. extrac.
2— 2,500 KW Turbo-Generators and Condensers
3— 2,000 KW Turbo & Condenser
2— 1,500 KW Turbo & Condenser
2— 1,250 KW Turbo & Condenser
2— 1,000 KW Turbo & Condenser
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2—4000 KW, 4160 V, 600# NEW
2—4000 KW, 2300 V., 150# Cond.
1—3500 KW, 2300 V., 150# Cond.
1—3500 KW, 4000 V., 150# Cond.
1—3000 KW, 4000 V., 150# Cond.
1—2500 KW, 480 V., 150# Cond.
1—2500 KW, 550 V., 250# Cond.
1—2000 KW, 550 V., 175# Cond.
1—1500 KW, 2300 V., 200# Cond.
2—1250 KW, 2300 V., 225# Cond.
1—1000 KW, 2300 V., 250# Cond.
1—1000 KW, 4150 V., 200# N.C.
2—1000 KW, 460 V., 180# Cond.
1—1000 KW, 480 V., 150# Cond.
1— 750 KW, 550 V., 170# Extr.
1— 750 KW, 2300 V., 175# Extr.
1— 500 KW, 2300 V., 170# Extr.
1— 300 KW, 2300 V., 150# Cond.
1— 300 KW, 2300 V., 200# N.C.
1— 150 KW, 2400 V., 150# N.C.

ENGINE GENERATORS

1—600 KW, 2300 V., Unit.
1—500 KW, 230 V., D.C., Unit.
3—375 KVA, 550 V., Unit.
1—312 KVA, 440 V., Unit.

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3—300 ton motor or turbine driven

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2—50,000#, 300#
1—30,000#, 425#
1—35,000#, 150#
2— 500 HP, 200#
3— 500 HP, 400#
1— 438 HP, 200#
2— 400 HP, 150#
4— 150 HP, 150# Sc. Mr.

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SLIP RING MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Speed
500	2200	G.E.	450
450	440/220	Whse.	514
400	2200	G.E.	1200
350	2200/440	G.E.	450
300	440	Whse.	3600
250	440/220	Whse.	600
250	2200/550	G.E.	450
250	550/440	G.E.	1200
200	440	G.E.	450
200	440	G.E.	450
188	4000/2300	G.E.	1800
150	440/220	Whse.	600
150	440/220	Whse. (2)	1800
145	4000/2300	G.E.	1800
125	550/440	G.E.	1200
100	440/220	G.E.	600
100 (2)	440/220	Whse.	900

SYNCHRONOUS MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	440/220	G.E.	ATI	600
300	2200/440	G.E.	TS	720
300	440/220	G.E.	ATI	600
250	440/220	Whse.	HR	277
250	440/220	G.E.	ATI	600
250	4000/2300	El. Mchy.	Sym.	600
240	2300/440	G.E.	ATI	720
200	440/220	G.E.	TS	720
200	4150/2300	Whse.	G	1800
120	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	440/220	Whse.	G	1800
75	2200/440	Whse.	GE	600

PLATING UNIT

1—5,000 amp., 6/6 volt (or 2,500 amps., 8/12 volts) A.P. Munning, double commutator, dir. conn. to 50 hp, G.E. sq. cage motor.

CIRCUIT BREAKERS

2—2000 amp., GE, E, 3 pole, 600 v., air
2—1600 amp., ITE, 3 pole, 600 v., air
2—1200 ampere, Whse., 3 pole, 600 v., air

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440	G.E.	FT	3600
500	2200/1000	Elliot	BC	1800
450	2200	G.E.	KT	1200
300	2200	G.E.	FT	3600
250	440	G.E.	IK	720
200	440	G.E.	IK	514
200	440/220	Whse.	C8	1200
200	440/220	G.E.	KT	1800
200	2200/440	G.E.	KF	720
200	2300/550	Cr. Wh.	SC	900
200	2200/440	G.E.	KT	1200
200	440/220	G.E.	IK	450
150	440/220	Whse.	C8	900
150	440/220	G.E.	IK	450
150	2200/550	Whse.	C8	900
150	440/220	G.E.	KT	720
150	440/220	Howell	B. Brg.	1800
150 vert.	440/220	G.E.	KTP	1200
150	440/220	G.E.	IK	514
150	2300/440	G.E.	KT	600
100	2200/440	G.E.	K	1200
75 (5)	550	G.E.	KF	1800

A. C. GENERATORS

1—320 kva, 600 rpm, 2300/440/220 V., G.E.
1—250 kva, 720 rpm, 2,400/440 v., G.E.
1—225 kva, 600 rpm, 220/440 v., G.E.
1—225 kva, 720 rpm, 2300/440 v., G.E.
1—150 kva, 900 rpm, 480/240 v., G.E.
3—75 kva, 1800 rpm, 480/240 v., Whse.

D. C. MOTORS

HP	Volts	Make	Type	Speed
300	230 (2)	G.E.	CD	1150
250	230 (2 new)	Cr. Wh.	CMC	1800
150	230 (2)	Whse.	SK	850
150	230	Cr. Wh.	TEFC	900
100	230	Cr. Wh.	CMC	625
100	230	G.E.	CD	1750
75	230	G.E.	CD	1150
75	230	Whse.	SK	850

MOTOR GENERATOR SETS

1—200 kw, 1200 rpm, 250 V., Whse., conn. to 350 hp, 1200 rpm, 2,300 v. sq. cage
1—165 kw, 1200 rpm, 240 v., G.E., conn. to 250 hp, 1200 rpm, 440/220 v., squirrel cage
1—100 kw, 250 v., Hertner, 1200 rpm, connected to 150 hp, 220/440 v., synchronous
1—75/90 kw, 250 V., 1200 rpm, G.E. conn. to 135 hp, 440/220 V., sq. cage
1—75 kw, 125 v., 1200 rpm, G.E. conn. to 120 hp, 2200/440 v., sq. motor.
1—50 kw, 250/125 V., 1200 rpm, 3-wire, G.E., conn. to 75 hp, 440/220 V., sq. cage

TRANSFORMERS 60 Cy.

3—333 kva, G.E., 13,200—2300 V.
3—333 kva, Whse., 2400—480/240 V., Dry
4—250 kva, G.E., 6900/13,800—230/460 V.
3—250 kva, Whse., 11,000/22,000—2300 V.
4—250 kva, Whse., 2300—208 V.
3—200 kva, Whse., 13,200—2300 V. (fourteen)
6—150 kva, Al. Chal. 2400—240/120 v.
1—150 kva, Whse, SK, 13200-125/215 v., 3 ph.
3—100 kva, Whse., 4600/2300—230/115 V.
3—100 kva, G.E., 4600/2300-230/115 v., NEW
3—100 kva, G.E., 450-115/230 v., dry, 1 ph. new
2—75 kva, G.E., 480—240/120 v., Pyranol
3—50 kva, G.E., 480—240/120 V., Pyranol

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1—1250 HP B&W cross drum steel header, 225# press.
2—400 HP B&W 200# press. steel header
1—10,000 KW; 1—5000 KW Turbo Generator surface condensers
1—1000 GPM solid bronze, water end motor driven pump
4—285# pressure turbo boiler feed pumps
Heat Exchangers—piping—valves—etc.

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1—**ERIE CITY BOILER**, 420 H. P., 3 drum, type 4-C-24, 200 lb. pressure, new in 1945

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40,000 lbs. Int. Furnace 400# (almost new)
480 HP Sectional Header 250#, 100° S.H.

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MOTORS—M.G. SETS—TRANSFORMERS

SQUIRREL CAGE MOTORS
3-Ph., 60-Cy.

Qu.	HP	Make	Type	Volts	RPM
1	400	G.E.	IK	2300	514
1	400	G.E.	KT-412	2300	450
1	300	Al. Ch.	AR	440	1760
1	250	Whse.	C8	2200	1160
1	200	Al. Ch.	AR	220/440	580
2	125	Al. Ch.	AR	2300	1750
1	125	Whse.	C8-761	440	1750
1	125	G. E.	KT-568	2300	875
3	125	C.W.	126Q	440	430
3	100	Whse.	C8-663	440	1750
1	100	Al. Ch.	AR-256	2300	1160
5	100	F.M.	HS-281C	440	880
1	100	Al. Ch.	AR	550	690
1	100	F.M.	H-241B	440	450
1	100	Whse.	C8-938	2300	514
1	100	Al. Ch.	AR	440	695

SLIP RING MOTORS—CONSTANT DUTY—3-Ph., 60-Cy.

Qu.	HP	Make	Type	Volts	RPM
1	3000	G.E.	MT	2200	356
1**	2600	G.E.	MT-30	2300	340
1**	1500	Al. Ch.	ANY	2200	230
1**	1200	Cr. Wh.		2200	237
2**	1000	Al. Ch.	ANY	2200	235
1	1000	Whse.	CW	2200	444
1**	600	G.E.	MT-412	2200	719
2	500	G.E.	I-16-M	2300	450
1***	400	G.E.	MT-574	550	585
1**	400	G.E.	I-M	2300	590
1**	400	Al. Ch.	ANY	2200	585
3	400	G.E.	MT-412	2300	440
1	300	G.E.	I-E15-M	2300	1200
1	300	Al. Ch.	ARY	2300	505
1	250	Al. Ch.	ARY	440	440
1	250	Whse.	CW-1106	2200	580
1	250	Whse.	C.W.	550	514
1	250	G.E.	MT-414	2200	300
1	200	G.E.	13I	2300	600
1	150	G.E.	I-E13 M	2300	1750
1***	125	Whse.	C.W.-870	2200	900
1	100	F.M.	420-C	440	900

—Mill type pedestal bearing. *—S-bearing.

SYNCHRONOUS MOTORS
3-Ph., 60-Cy.

Qu.	HP	Make	P.F.	Volts	RPM
1	4000	Whse	.8	5000	600
1	2500	Whse	1.	4000/2400	720
1	1500	Whse	.8	2200	720
1	700	G.E.	.8	2300	720
1	450	G.E.	.8	440	360
1	400	Whse	.8	440	600
1	268	Al. Ch.	1.	2200	900
2	250	Al. Ch.	.9	2300	514
1	200	Whse	.8	440	300
1	150	G.E.	1.	2200	900
1	150	G.E.	.8	550	450
1	150	G.E.	.8	2200	600
1	125	El. Mch.	1.	4000/2400	900
1	125	G.E.	.8	2200	900
3	100	Whse	.8	440	1800
1	100	Whse	1.	2200	1200
1	100	Ideal	.8	440	900
2	100	G.E.	.8	440	600

With the above we can supply manual, semi-magnetic or full magnetic, reduced or full voltage control.

TRANSFORMERS—(OIL COOLED)

Qu	K.V.A.	Make	Type	Phase	Voltage
2	4500	G.E.	HT	3	27000/13500/2300
3	4000	G.E.	H	3	22000/2300/4000Y
1	3750	Whse	S	3	67000/14400/2400
5	500	G.E.	HT	3	14400/13200/480
3	500	G.E.	H	1	12300/11880/220/440
30	100	G.E.	HT	1	14400/12870/240/480
3	100	Whse	AUTO	1	2400/4160Y/1385/2400Y
3	100	Whse	S8	1	12075/10855/230/460

MOTOR GENERATOR SETS

Qu.	KW	Make	R.P.M.	Volts DC	Volts AC
1	2400 (3U)	Al. Ch.	720	525	4800/2400
1	2000	Whse	600	600	2300
2	1500	Whse	514	250	4000/2300
1	1500 (3U)	Al. Ch.	720	525	4800/2400
2	1000	G.E.	514	575	4000/2300
1	750	Whse	900	600	2300
1	700 (3U)	G.E.	720	250	2300
1	600	G.E.	720	300	2300
1	500	Al. Ch.	720	525	2300
1	500 (3U)	Whse	1200	120/240	4000/2300
1	200	Whse	900	250	2300
1	200	Ridgeway	900	275	2200
1	156	G.E.	720	250	2300/440
1	150	Al. Ch.	1200	250	2300/440
1	100	Ridgeway	1200	275	4000/2300
3	85	C.W.	1200	250	2300/440
1	75	Whse	900	75	2300
1	75	Al. Ch.	900	250	2300
1	75	Star	1200	250	440/220
2	25	Whse	1200	120/240	440/220

3U—3 unit set

ROTARY CONVERTERS

2625/2565 K.W. 225/285-V D.C., G.E., 9000 Amp., 450-R.P.M., with booster.

2760—K.V.A. Trans., 6900-Y, 3-PH., 60-CY., complete control. & C.D. distribution cubicles.

Will Rewind Transformer to Suit Your Current.

DIRECT CURRENT MOTORS

Qu.	HP	Make	Type	RPM
1***	3000	Whse	Encl (Rev)	600
1***	2400	Whse	Encl (Rev)	600
1***	1600	Whse	Encl (Rev)	600
6***	1500	Whse	Encl (Rev)	600
4***	1200	Whse	Encl (Rev)	600
2***	1250	Whse	Mill (Rev)	300/600
4***	800	Whse	Encl (Rev)	600
1	400	Al. Ch.	Mill	400/1200
1	350	G.E.	CD 169	1150
1	335	Whse.	QM	450/900
1	200/250	El. Dy.	#22	400/1200
1	200	Whse.	Mill (Rev)	300/1200
1	180	G.E.	MPC	600
1	150	Al. Ch.	Mill (Rev)	400/1200
2*	150	Cr. Wh.	82H	800
1***	125	Whse	81C-190	600
1	100/125	Rel	1895 F	300/1200
2	100	Rel	1050 T	400/1200
1	90/100	G.E.	MPL	625/1125
1*	50/75	Rel	1895 F	300/1200
1*	30/75	Whse	8K 151 L	400/1200
1	50	Whse	8K	300/1200
1	40	Al. Ch.	E 127	850/1750
1	35	G.E.	CD 125	400/1200
1	35	G.E.	CD 147	300/1200
2	35	G.E.	HF 14	500/1500
1	35	Rel	T	250/1000
1	32½	Whse	8K 150	400/1200
2	25	G.E.	CD 133	400/1200

Above are all 230 V DC except where marked ***

***—Pedestal Bearing 525/600 V DC Mill design

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1—4" GOULDS 500 GPM, 1320' Hd. 3500 RPM, Fig. 3360, 250 HP.

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3	167	2400/4160Y	120/240

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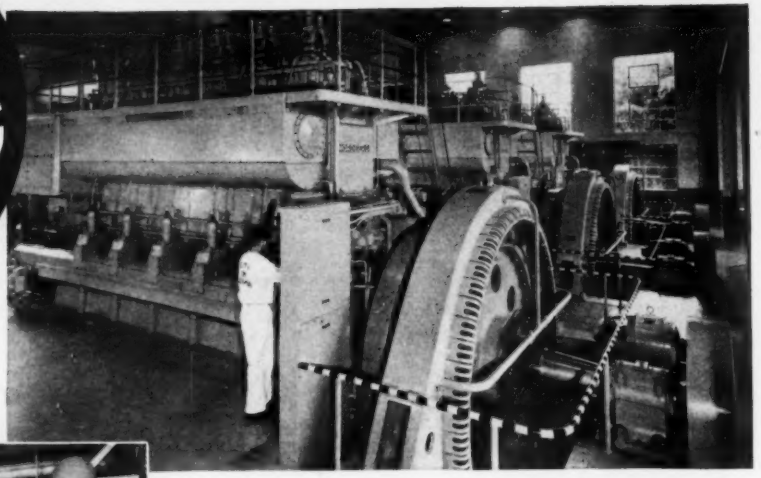
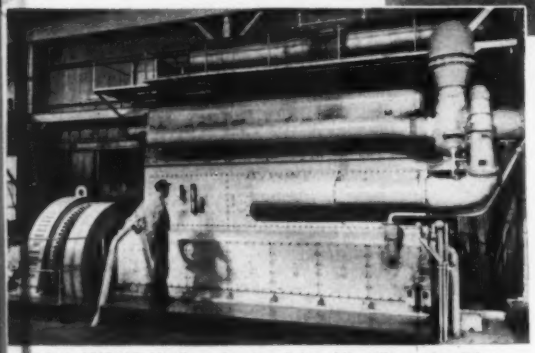
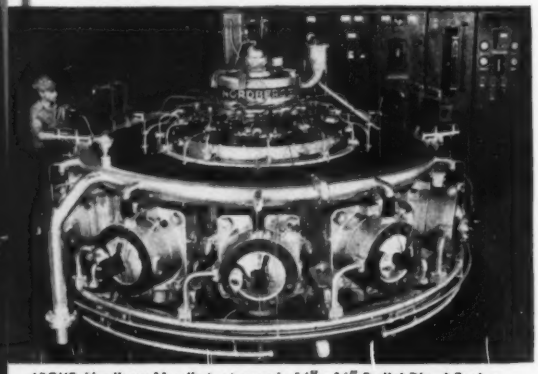


RIGHT: Group of three 5-cylinder 2000 H.P. Nordberg two-cycle Gas Burning Diesels in municipal plant at Houma, La. Other two-cycle Diesels are built in oil or Duafuel types in sizes from 880 to 9600 H.P.



ABOVE: 1220 H.P. Nordberg 4-cycle unit in public utility service. Other 4-cycle oil burning and Duafuel units are built in five different cylinder bores, in sizes up to 2100 H.P.



ABOVE: Nordberg 11-cylinder two-cycle 14" x 16" Radial Diesel Engine, developing 1650 H.P. at 400 rpm. Available as an oil burning Diesel, as a natural gas engine, or as a Duafuel engine . . . for industrial and municipal power plants and central stations.

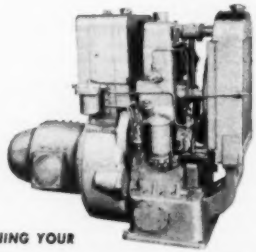
BUILDERS OF AMERICA'S LARGEST LINE OF HEAVY-DUTY DIESELS . . . 10 to 9600 H.P.

In the complete line of Nordberg two and four-cycle oil burning and Duafuel Diesels and gas burning engines, you will find the right size and type of units to meet practically every power requirement.

From the smallest to the largest unit, every Nordberg engine is built to deliver low-cost, dependable power . . . and the basic dependability of Nordberg engines has been amply proved in service on hundreds of successful stationary and marine power applications all over the world.

If you plan to add to present power capacity, or provide new power facilities, it will pay you to investigate the long, economical and dependable service assured with Nordberg Engines.

NORDBERG MFG. CO., Milwaukee 7, Wis.



RIGHT: Nordberg four-cycle 4½" x 5¼" Diesel power unit. Built in both 1 and 2 cylinder models, developing from 10 to 30 H.P. Available for direct drive with clutch or stub shaft power take-off, as an electric-generating set (6 to 20 K.W.), or as a self-contained pumping unit.

WRITE FOR FURTHER DETAILS OUTLINING YOUR POWER REQUIREMENTS.

P1150

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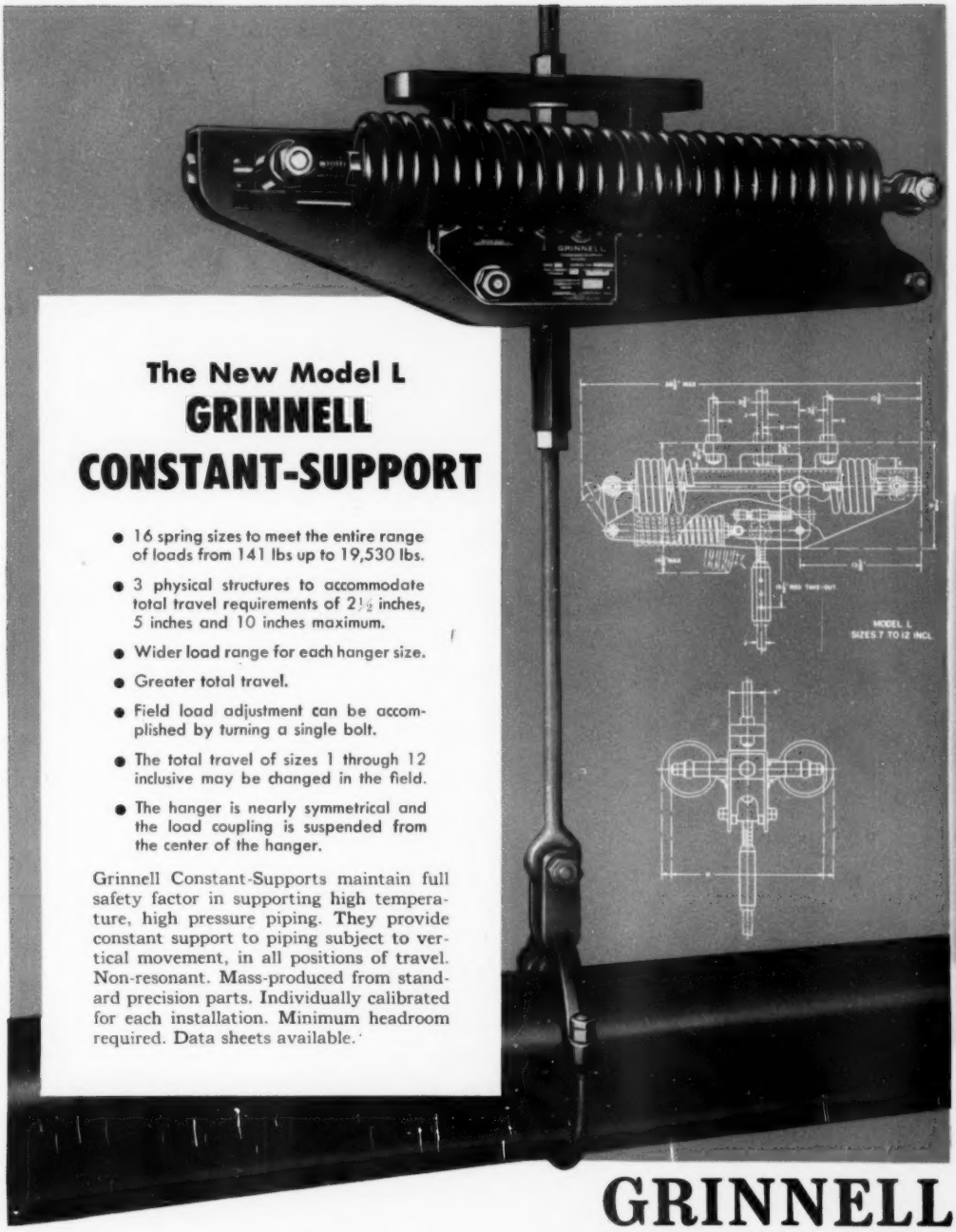
NORDBERG
DIESEL ENGINES



The New Model L
GRINNELL
CONSTANT-SUPPORT

- 16 spring sizes to meet the entire range of loads from 141 lbs up to 19,530 lbs.
- 3 physical structures to accommodate total travel requirements of 2½ inches, 5 inches and 10 inches maximum.
- Wider load range for each hanger size.
- Greater total travel.
- Field load adjustment can be accomplished by turning a single bolt.
- The total travel of sizes 1 through 12 inclusive may be changed in the field.
- The hanger is nearly symmetrical and the load coupling is suspended from the center of the hanger.

Grinnell Constant-Supports maintain full safety factor in supporting high temperature, high pressure piping. They provide constant support to piping subject to vertical movement, in all positions of travel. Non-resonant. Mass-produced from standard precision parts. Individually calibrated for each installation. Minimum headroom required. Data sheets available.

MODEL L
SIZES 7 TO 12 INCL

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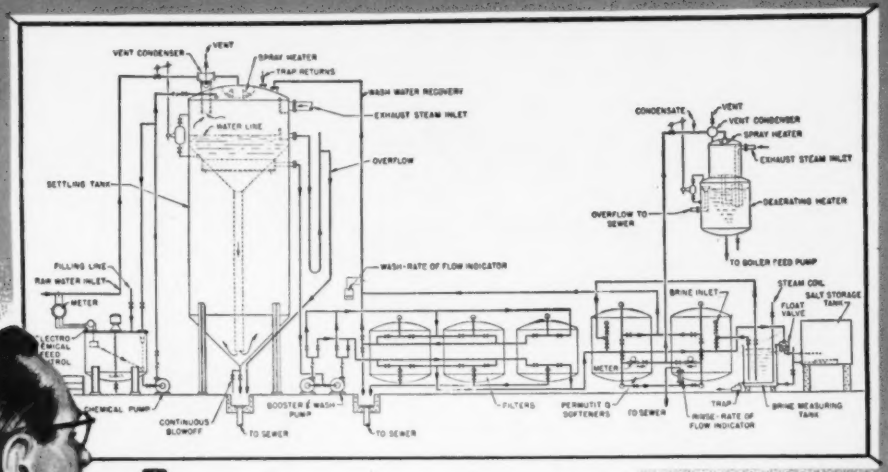

"...have you heard about Permutit's New Hot Zeolite Process?

"Permutit announced the process only a few months ago, but already we're putting it to good use in our plant. We think it's the best way of producing water that's low in alkalinity and silica . . . and with all hardness removed."

"Say, Ed, that's really something . . . getting an effluent of zero hardness from a hot lime soda softener! How's it possible?"

"Well, you see, Joe, they've developed a new mineral, Permutit Q. It's an ion exchanger that will withstand boiling water with a pH over 10, and it's not affected under operating conditions like that even after 1300 regeneration cycles."

"Tell me more! Is Permutit Q more economical than phosphate?"

"It is, and what's more, it reduces CO_2 in the steam. I'm really sold on this new process, because our chemical costs are lower, our effluent is lower in alkalinity and total solids, and we don't need acid feeding to prevent deposits in our high stage heaters and economizers."

"The more you tell me, Ed, the more I want to know. I think we could put this new hot zeolite process to work in our plant, too. How can I find out full information about it?"

"If you write to Permutit, they'll send you a new bulletin *full* of information. I have their address somewhere . . . oh yes! It's The Permutit Company, Dept. P-2, 330 West 42nd Street, New York 18, N. Y. Then there's the Permutit Company of Canada, Ltd. at 6975 Jeanne Mance Street, Montreal."

"Thanks for the tip, Ed. I'm sending them a letter today!"

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